



Opinion **Dynamics**

MASSACHUSETTS CROSS-CUTTING BEHAVIORAL PROGRAM EVALUATION INTEGRATED REPORT JUNE 2013

Prepared for:

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1. EXECUTIVE SUMMARY

This report serves as the third annual impact and process evaluation of the Massachusetts Behavior/Feedback Programs and Pilots. This evaluation falls under the Massachusetts Cross-Cutting Program Evaluation conducted by Opinion Dynamics with subcontractors Navigant Consulting and Evergreen Economics.

1.1 INTRODUCTION TO THE PROGRAMS

Four Massachusetts program administrators (PAs) currently offer three different Behavior/Feedback Programs and Pilots. These are:

- (1) The OPOWER Home Energy Report (HER) program (henceforth referred to as OPOWER HER) is implemented by National Grid (NGRID) and NSTAR. The NGRID and NSTAR OPOWER HER programs randomly assign qualifying customers to treatment and control groups. The treatment groups receive mailer-based reports on an ongoing basis (bi-monthly or quarterly) and have access to an online portal. Throughout this report, we refer to each group of customers treated as a “cohort.” Combined, the OPOWER HER programs have 16 total cohorts that we discuss throughout this evaluation.
- (2) The C3¹ Western Mass Saves (WMS) program (henceforth referred to as C3 WMS) is implemented by Western Massachusetts Electric Company (WMECo). The C3 WMS program is comprised of two primary elements: (1) an online web platform available to all WMECo customers; and (2) Energy Savings Reports (ESRs) distributed by mail to randomly assigned treatment customers. In addition, the program uses community-based outreach to help further drive participation, though this represents a minor portion of its work. Program participants fall into two classes: (1) “passive” participants that receive the ESR but do not use the web portal; and (2) “activated” participants that actively opt-in to the web portal (either through the ESR or other marketing and outreach activities).
- (3) The Smart Home Energy Monitoring Pilot (SHEMP) is implemented by Cape Light Compact (CLC). CLC’s SHEMP is an opt-in pilot that offers an integrated in-home monitoring and feedback system for customers on their household energy usage. Through this pilot, customers have access to near-real-time data on their electric energy use based on the theory that, in response to this information, they will reduce their consumption. Customers receive the information through a website where they can set goals and update their profile based on their home characteristics and any relevant household changes. SHEMP is made up of two primary cohorts: (1) “Legacy” households that are using the iCES platform, originally developed by Grounded Power; and (2) “Energize” households that are treated with the Energize platform developed by Tendril (who acquired Grounded Power).

This report includes impact findings of behavioral initiatives administered by NGRID, NSTAR, WMECo, and CLC during the 2012 program year. It also includes process findings for CLC’s SHEMP.

¹ Formerly Efficiency 2.0.

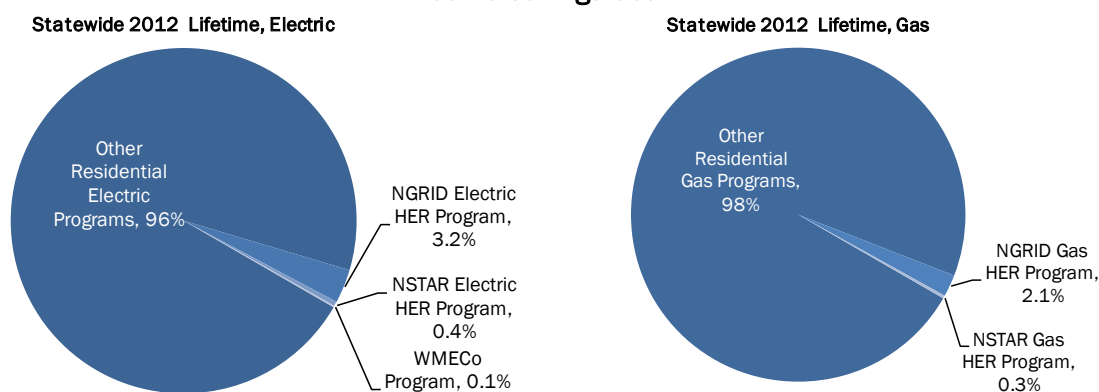
1.2 OVERALL STATEWIDE FINDINGS

What Are the Overall Statewide Impacts of the Behavioral Programs?

- The 2012 impacts for the NGRID and NSTAR behavioral programs range from 41 kWh to 258 kWh per household for the electric cohorts, and from 0.28 MMBtus to 1.90 MMBtus for the gas cohorts.
- Since their start in 2009, the NGRID and NSTAR behavioral programs have generated a total of 113,827 MWh and 710,255 MMBtus in energy savings. Since its start in 2010, the WMECo behavioral program has generated a total of 5,036 MWh in energy savings.
- The Massachusetts statewide goals are measured in lifetime benefits. In 2012, the NGRID, NSTAR, and WMECo behavior programs generated 65,582 megawatt hours (MWh) and 344,682 million British thermal units (MMBtus) in energy savings. As such, the 2012 program cycle savings achieved through the behavioral programs represent 3.7% of the total 2012 preliminary statewide lifetime electric savings goal and 2.4% of the total 2012 preliminary statewide gas lifetime savings goal.^{2,3}
 - The NGRID behavioral program represented 3.2% and 2.1% of the 2012 preliminary statewide lifetime electric and gas savings goals, respectively.
 - The NSTAR behavioral program represented 0.4% and 0.3% of the 2012 preliminary statewide lifetime electric and gas savings goals, respectively.
 - The WMECo behavioral program represented 0.1% of the 2012 preliminary statewide lifetime electric savings goals.

It is important to note that these differences are largely a result of program investment across the PAs, rather than a reflection of program effectiveness, which we detail in the next section.

Figure 1. Behavioral Programs Achieved Savings as a Percent of 2012 Massachusetts Statewide Lifetime Savings Goal

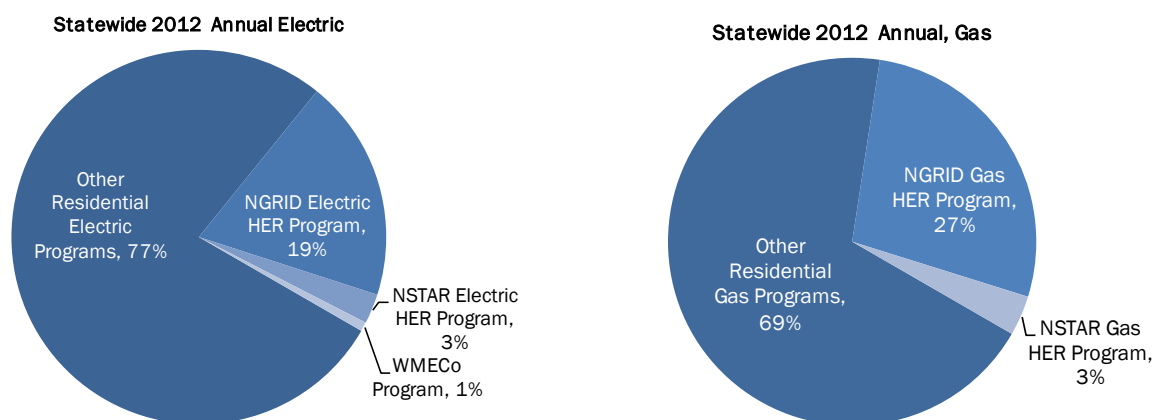


² The 2012 statewide lifetime and annual (electric and gas) savings goals are taken from the "Statewide Q4 2012 Quarterly Report."

³ The measure life for the OPOWER HER programs is one year.

- The 2012 program cycle savings achieved through the behavioral programs represent 23% of the total 2012 statewide annual electric savings goal and 31% of the total 2012 statewide annual gas savings goal in Massachusetts.
 - The great majority of these 2012 savings (55,785 MWh and 305,798 MMBtus) were gained through the NGRID program, which represented 19% of the 2012 statewide annual electric savings goal and 27% of the 2012 statewide annual gas savings goal.
 - The NSTAR program is smaller in scale and represented about 3% each of the 2012 statewide annual electric and gas savings goals. The NSTAR program achieved a savings of 7,534 MWh and 38,883 MMBtus in 2012.
 - The WMECo program is also smaller in scale and represented about 1% of the 2012 statewide annual electric savings goal. The WMECo program achieved a savings of 2,263 MWh in 2012.
 - In 2012, the annual planned budget for the NGRID program was \$6,053,162 (\$3,374,377 for the electric cohorts and \$2,678,785 for the gas cohorts). The annual planned budgets for the NSTAR and WMECo programs were relatively smaller, at \$1,030,750 for NSTAR (\$714,662 for the electric cohorts and \$316,088 for the gas cohorts) and \$184,859 for WMECo. Given this difference in investment, it is expected that the NGRID contribution to the overall statewide goals is greater than NSTAR and WMECo.

Figure 2. Behavioral Programs Achieved Savings as a Percent of 2012 Massachusetts Statewide Annual Savings Goal



1.3 KEY FINDINGS FOR THE NGRID AND NSTAR MODEL

Can the NGRID and NSTAR Behavioral Programs Generate Persistent Savings?

- All OPOWER HER behavioral programs have demonstrated persistent and increasing savings with continued treatment.

- Electric programs have demonstrated an average adjusted net savings gain of 27% from PY1 to PY2, and 16% from PY2 to PY3.
- Gas programs have demonstrated an average adjusted net savings gain of 20% from PY1 to PY2, and 23% from PY2 to PY3.

What Are the Impacts of the NGRID and NSTAR Behavioral Programs on Overall Statewide Program Participation?

- Since 2009, behavioral programs have channeled 24,122 additional participants⁴ into other residential programs, resulting in a savings of 5,298 MWh and 28,581 MMBtus.⁵
- Slightly over half of the total channeled participants came from 2012, where the opt-out behavioral programs channeled a total of 13,243 additional participants into other residential programs. The savings associated with these participants equaled 3,858 MWh and 27,203 MMBtus in 2012, representing 0.2% of each of the 2012 preliminary statewide lifetime electric and gas savings goals.
- The savings represent 1.3% and 2.4% of the 2012 statewide annual electric and gas preliminary savings goals, respectively. These savings are comparable to the annual savings goals for programs, such as the Residential New Construction and Major Renovation program (2012 goal of 4,716 MWh) and the Multifamily Retrofit program (2012 goal of 34,650 MMBtus).
- The incremental savings from other programs represent a small fraction of the 2012 savings associated with behavioral programs (1.74% across all cohorts in 2012 and 2.02% across all cohorts since 2009).

Approach for Applying Savings Estimate Ratio for the HER Program

In this report, we provide a Savings Estimate Ratio to reduce the need for continued annual evaluations of the OPOWER HER programs. The Savings Estimate Ratio would be used to adjust implementer estimates of savings based on comparison of treatment and control group usage for each month of participation. Our results support this approach, as there are three years of program implementation showing relatively stable findings over time. Nevertheless, there are minor differences between the OPOWER-estimated savings and the Evaluation Team-estimated savings for some cohorts, especially in the first years of the programs. To ensure that the continued investment in the program is warranted beyond year three, we recommend conducting bi-annual (every two years) impact evaluations until there is sufficient evidence to support an approach that can be used for a period longer than two years.

The Evaluation Team recommends using the following Savings Estimate Ratios for the NGRID and NSTAR electric and gas cohorts:

⁴ Additional participants refer to the numbers of participants in the treatment group above the control group. This is the result of the Difference-of-Differences analysis performed in the Channeling analysis.

⁵ The Evaluation Team did not adjust for upstream program savings in this analysis based on the survey research detailed in the 2010 Behavioral Report, Volume II. However, given that this study was performed in 2010, the results should be re-validated for the next program cycle.

Table 1. Savings Estimate Ratios

	Savings Estimate Ratio
NGRID Electric	105%
NGRID Gas	111%
NSTAR Electric	90%
NSTAR Gas	97%

Section 4.2 provides more details on these recommended ratios.

1.4 KEY FINDINGS FOR THE WESTERN MASS SAVES PROGRAM MODEL

Can the Program Generate Persistent Savings?

- The WMECo program achieved a total savings of 2,263 MWh in 2012. The program has generated savings that persist. For the initial wave of customers receiving HERs beginning in November 2010, total program savings in 2012 are 2,008 MWh, with average household savings of 1.08%.
- Moreover, about 85% of customers activated the web portal before 2012, and yet savings for activators ranged between 0.91% for those originating from the control group of the initial wave (78% of whom activated the web portal before November 2011) and 1.9% for those activators from neither the initial nor expansion waves of the experimental design (93% of whom activated before November 2011).

What Are the Impacts of the Program on Overall Statewide Program Participation?

- The program has had a substantial positive impact on participation in energy efficiency programs. For instance, online activation of the web portal has increased participation in the Mass Save program by 431 customers in 2012, and the total savings from increased participation in energy efficiency programs that can be attributed to the WMS program in 2012 is 661 MWh. This finding is significant, as these savings are persistent measure-based savings that would not have been generated in the Mass Save program without the efforts of WMS.

1.5 KEY FINDINGS FOR THE CAPE LIGHT COMPACT PILOT MODEL

What Are the Impacts of the Pilot?

Our research indicates that the two SHEMP cohorts (Legacy and Energize) generated very different pilot effects. Due to differences in treatment approaches and customers reached, we cannot directly attribute these differences to either the pilot model or the specific customers reached. However, our secondary research suggests that the pilot-specific changes may have had an impact on customers' behavioral responses.

- There are significant savings differences between the SHEMP Legacy and Energize customers. Based on our estimates:
 - Legacy customers' savings range from 7.8% to 8.8% average savings per household.
 - Energize customers' savings estimates are significantly lower, ranging from 1.49% to 1.99% average savings per household.
- Similar to differences observed in savings, we see dramatic differences between SHEMP Legacy and Energize cohorts' cross-program participation levels. Specifically:
 - Legacy customers demonstrated a sharp increase in cross-program participation during the Legacy participation period. Roughly three to six months after pilot participation began (the participation period started between June and September 2009 for different customers), we observed a sharp increase in other program participation. However, this trend leveled off after 12 to 18 months of treatment.
 - Energize customers' monthly cross-program participation dropped during the treatment period. These participation findings are consistent with the self-reported findings that customers do not appear to be increasing their measure-based actions during the pilot period.

Can Behavioral Pilots Generate Persistent Savings?

The CLC SHEMP effort demonstrated persistent energy savings from 2009 to 2012 for the Legacy pilot participants. The 2009 PA Consulting Group Report⁶ showed a savings of 9.3% per household, indicating that the savings for this pilot have remained relatively stable with treatment, with a modest decrease from the 2009 estimates to our savings estimates of 7.8% to 8.8% per household.

What Is the Process Feedback from Energize Customers?

We conducted a post survey with Energize customers to obtain process feedback and examine customers' engagement with Energize offerings and their behavioral responses to the pilot. We found the following for Energize customers⁷:

- Nearly half of Energize customers (47%) continue to use both the device and website after 12 months, and 12% of original participants no longer engage the device. Across all participants who have received the device, just under half (47%) say that they still use both the device and the website, while slightly fewer (40%) say that they use the device only. Most participants who removed the device (12% of all participants) said that they use neither the device nor the website. Only one customer reported using the website and not the device.
 - Engagement with the in-home display tends to decrease over time. Nearly half (47%) of the customers report using the in-home display less frequently than when they first installed it, while only a few (8%) said that they engaged with the information more frequently.

⁶ Cape Light Compact, Residential Smart Energy Monitoring Pilot, Final Report (March 31, 2010) <http://tomharrisonjr.com/wp-content/uploads/2010/08/CLCSmartEnergyMonitoringPilotFinalReport3-31-2010.pdf>.

⁷ Note that Legacy customers were not surveyed for this study.

- Many customers are not accessing the SHEMP website, and those who do access it infrequently. About half (54%) of customers have accessed the website since enrolling in Energize. Over a third of customers (39%) who use the website access it at least every three months, and a quarter (24%) access it at least once per month.
- Energize participants need more specific, actionable educational material than what is currently provided on the in-home display (IHD) to take action. Less than half of customers (48%) said they had enough information to take action from the IHD alone. Slightly more than half (54%) of those who logged on to the pilot website said that they found enough information from the site to take energy-saving actions at home.
- Awareness of alternative CLC programs is generally higher once customers have participated in SHEMP. Half (50%) of participants in the pre-period are aware of alternative programs to Energize offered by CLC, compared with more than half (62%) of participants in the post-period. However, this does not appear to be translating to more pilot participation.
- CLC Energize participants reported making few changes to their household equipment and behaviors during the pilot period, but many had taken actions in the 12 months before enrolling. Pre-period actions were much greater for low-cost measures and for energy efficiency appliances as compared to self-reported actions in the post-period. Notably, the percentage of respondents who reported installing these measures during the pre-treatment period was already high (51.9% low-cost measures, 28.6% appliances). This indicates that many participants put new energy-efficient measures in place shortly before they installed the IHD, and may have had limited opportunities to do so in the post-period. Only one post-period action indicated an increase; that was the installation of on-demand tankless water heaters. These findings are consistent with our findings in the cross-pilot participation analysis, and align with the lower observed savings estimates (as compared to Legacy customers).
- Furthermore, respondents did not report major changes in behavior during the pilot period, with the exception of a significantly higher number reporting that they hang laundry to dry. This indicates that customers may be taking smaller conservation actions as a result of the pilot treatment, some of which may not have been directly measured in the survey.

Specific process-related recommendations for SHEMP are discussed in Chapter 7.

1.6 CONSIDERATIONS FOR FUTURE RESEARCH

We have four considerations for future research related to measuring the impacts of the Massachusetts Behavior/Feedback Programs and Pilots, which we provide next.

1.6.1 For All Program Models, Examine Savings Gained through Program Channeling

Most behavioral programs promote other resource programs through their outreach efforts. With the exception of estimating double-counting, little is known about the effects of behavioral programs on the overall portfolio of residential programs.⁸ For instance, are customers who participate in

⁸ Notably, this does not hold true for the CLC pilot.

behavioral programs more likely to take deeper energy-saving actions in other programs? Do we see clear participation trends in other programs as a result of behavioral program promotional efforts?

These questions can be examined through careful review of channeled savings data, and represent obvious and simple next steps in furthering this analysis. The results may be instructive for program planning and may offer guidance on how to leverage behavioral programs to advance the state's energy goals.

1.6.2 Examine Persistence for the NGRID, NSTAR, and WMECo Programs

Previous survey research indicates that all programs' savings will demonstrate some savings persistence after treatment ends due to measure savings. However, the exact percentage of savings and the duration of persistence are unknown.

Currently, behavioral programs are estimated to persist only for the duration of treatment. However, there is evidence to suggest that some portion of these program savings will persist beyond one year. The persistence effect captures the extent to which repeated intervention induces households to change appliances/habits, which in turn causes changes in outcomes to last longer after the intervention ends.

HER Program

To further investigate the persistence of the HER program, the Evaluation Team recommends conducting a behavioral persistence study. To assess persistence, a portion of randomly selected customers from each of the gas and electric program cohorts should stop receiving treatment. Any changes in savings will be observed over time through bi-annual billing analyses to detect savings decay in the absence of the treatment. This impact analysis will help assess whether savings will continue into the future, which could help determine program cost-effectiveness.⁹

WMS Program

The WMS program has shown persistent savings across its customers. Further, more than the others, this program shows a significant channeling effect into other programs. We suggest further investigating the persistence trends of this program as well as the added value to the portfolio of driving significantly greater rates of participation among WMS customers.

1.6.3 Continue to Evaluate WMECo and CLC Behavioral Programs and Pilots on an Annual Basis

To date, little is known about the stability of savings from WMECo and CLC behavioral models due to their lack of maturity as programs. For this reason, we suggest continued evaluations of each program/pilot model on an annual basis.

⁹ The Evaluation Team will be examining persistence in 2013 and 2014.

1.6.4 Formalize a WMS Program Implementation Strategy and Evaluation Approach

The WMS program has gone through multiple iterations since its launch as a pilot. The Evaluation Team suggests that the WMS program develop a formal logic model and implementation plan to document its program strategy and approach. This effort will serve as the basis for developing a standardized approach for evaluating the WMS programs, which should be further explored and considered in this evaluation.

2. INTRODUCTION TO THE PROGRAMS AND THE EVALUATION

This report provides the findings from the 2012 annual impact and process evaluation of the Massachusetts Behavior/Feedback Programs and Pilots.¹⁰ Opinion Dynamics Corporation, with subcontractor Navigant Consulting and Evergreen Economics (henceforth the “Evaluation Team”), were contracted to conduct this evaluation through 2012. This represents the third formal report of the three-year evaluation under the Massachusetts Cross-Cutting Program Evaluation contract.

In this section, we briefly describe: (1) the programs and pilots evaluated in this report; (2) the researchable issues addressed in the impact and process evaluation; and (3) the structure of this report.

2.1 PROGRAMS EVALUATED

This report covers all three programs or pilots implemented during 2009–2012, which includes: (1) OPOWER Home Energy Report (HER) administered by National Grid and NSTAR; (2) C3 Western Mass Saves (WMS) program administered by Western Massachusetts Electric Company (WMECo); and (3) Smart Home Energy Monitoring Pilot (SHEMP) implemented by Cape Light Compact (CLC).

Behavioral programs and pilots implemented in Massachusetts fall into two primary implementation models: opt-out and opt-in.

- **Opt-out models** assign customers to treatment. Customers have the choice to opt-out of programs, but are not directly asked if they want to participate before receiving treatment. The OPOWER HER program is the most common behavioral program in this model.
- **Opt-in models** are where customers specifically choose to participate in the program. These programs include a wide range of efforts, from online portals to in-home displays.

Opt-in customers are, overall, more motivated to take action and generate high savings per customer than opt-out programs. However, because customers have to initiate participation, the reach of opt-in programs is much lower than that of opt-out.

Most of the customers treated in Massachusetts are participating in opt-out program models. The table below details the program cohorts currently treated in the state and their respective program models. Throughout this report, we detail the findings from each of the programs models. Overall, it is important to keep in mind the differences between the two when comparing savings results.

By the end of 2012, the behavioral programs and pilots reached over 760,000 Massachusetts customers using one of these two models. See Table 2 below.

¹⁰ Information about previous year’s evaluation can be found in our 2010 evaluation: *Opinion Dynamics (2011). Massachusetts Cross-Cutting Behavioral Program Evaluation. Oakland, CA: Presented to the Massachusetts Energy Efficiency Advisory Council.*

Table 2. Massachusetts Behavioral Programs

Model	Program	PA	Cohort	Program Start Date	Last Program Cycle End Date	Duration of treatment	Fuel type	Evaluated participants ¹¹
Opt-out	OPOWER	National Grid	2009	October 2009	September 2012	36 months	Electric	24,853
Opt-out	OPOWER	National Grid	2010	February 2010	January 2013	36 months	Electric	68,194
Opt-out	OPOWER	National Grid	2010 add	October 2010	September 2012	24 months	Electric	23,427
Opt-out	OPOWER	National Grid	2011	January 2011	December 2012	24 months	Electric	94,322
Opt-out	OPOWER	National Grid	2011 add	October 2011	September 2012	12 months	Electric	55,055
Opt-out	OPOWER	National Grid	2012 dual fuel	December 2012	November 2012	12 months	Electric	12,074
Opt-out	OPOWER	National Grid	2012	January 2012	December 2012	12 months	Electric	79,064
Opt-out	OPOWER	National Grid	2009	October 2009	September 2012	36 months	Gas	24,994
Opt-out	OPOWER	National Grid	2010	October 2010	September 2012	24 months	Gas	74,759
Opt-out	OPOWER	National Grid	2011	January 2011	December 2012	24 months	Gas	87,691
Opt-out	OPOWER	National Grid	2011 add	November 2011	October 2012	12 months	Gas	25,048
Opt-out	OPOWER	National Grid	2012 Dual fuel	December 2011	November 2012	12 months	Gas	13,052
Opt-out	OPOWER	National Grid	2012	January 2012	December 2012	12 months	Gas	83,938
Opt-out	OPOWER	NSTAR	Wave I	August 2010	December 2012	29 months	Gas	22,840
Opt-out	OPOWER	NSTAR	Wave II	February 2011	December 2012	23 months	Gas	22,108
Opt-out	OPOWER	NSTAR	Wave III	March 2011	December 2012	10 months	Electric	59,030
Opt-out	OPOWER	NSTAR	Wave IV	June 2012	December 2012	7 months	Electric	17,514
Opt-out	C3	WMECo	Initial Wave: Customers receiving reports	November 2010	December 2012	25 months	Electric	22,901
Opt-out/Opt-in	C3	WMECo	Initial Wave: Activated Customers	November 2010	December 2012	Variable	Electric	1,312
Opt-out	C3	WMECo	Expansion Wave: Customers receiving a report	July 2012	December 2012	5 months	Electric	85,963

¹¹ Note values presented here are for first-year participants where programs were implemented for more than one year.

Introduction to the Programs and the Evaluation

Model	Program	PA	Cohort	Program Start Date	Last Program Cycle End Date	Duration of treatment	Fuel type	Evaluated participants ¹¹
Opt-out/Opt-in	C3	WMECo	Expansion Wave: Activated Customers	November 2010	December 2012	Variable	Electric	5,100
Opt-in	C3	WMECo	Online Activators (customers activating the web portal but not in the program experiment design)	November 2010	December 2012	Variable	Electric	1,422
Opt-in	Tendrill	CLC	In-home display program	~June 2009	~May 2012	36 months	Electric	83
Opt-in	Tendrill	CLC	In-home display program	~June 2011	~May 2012	12 months	Electric	277

~ Enrolled was done on a rolling basis and as such the starting date for enrolled is noted here

Below we describe the two program models detailed in this report.

2.1.1 OPOWER HER Program (Opt-Out Model)

The OPOWER HER program model is implemented by both National Grid and NSTAR. The OPOWER HER program randomly assigns qualifying customers to treatment and control groups. The treatment groups receive mailer-based reports on an ongoing basis (bi-monthly or seasonally) and have access to an online portal. Control groups are retained for the purposes of evaluation. This program specifically targeted high-usage households.

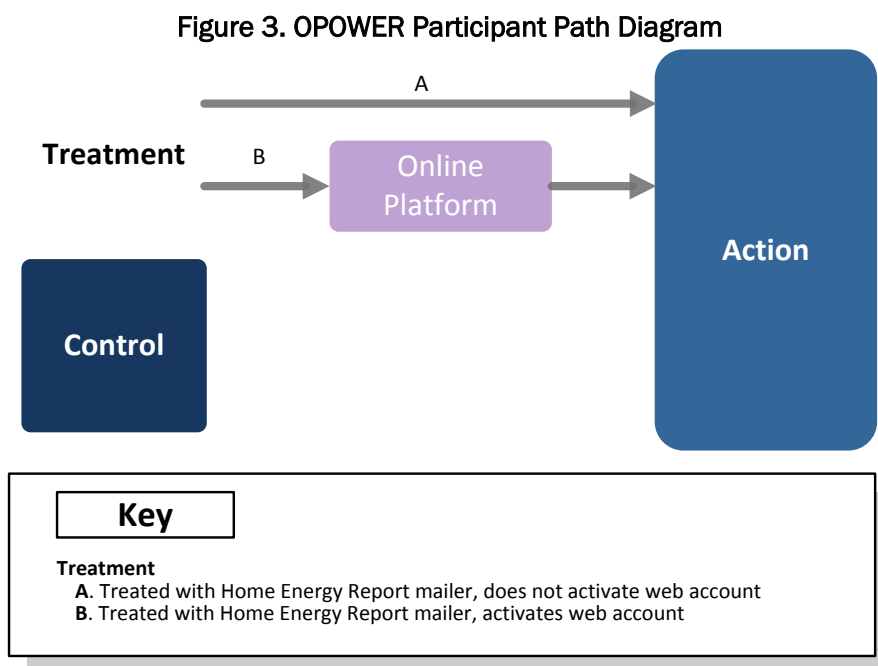
Each PA administers fuel-specific reports (gas, electric, or both) to groups of treatment customers who are assigned treatment at the same time (for example, October 2009). Customers then continue to be treated as a group indefinitely or until the PAs decide to stop treating customers. Because customers “enter” as a group at the same time, we refer to each distinct group of treatment customers as a “cohort” throughout this report. Below we briefly summarize each PA’s efforts.

Notably, the OPOWER HER programs are the only behavioral efforts currently implemented as full programs.

National Grid OPOWER HER gas and electric program: National Grid gas and electric OPOWER programs began in 2009, and continued to add additional cohorts of treatment customers into 2012. The result is 12 different treatment customer cohorts evaluated in this report.

NSTAR OPOWER Home Energy Report (HER) gas program: NSTAR’s program follows the same OPOWER model. NSTAR began implementing the OPOWER program in 2010 and has four cohorts of customers included in this study.

The diagram below shows the path to action for the OPOWER program.



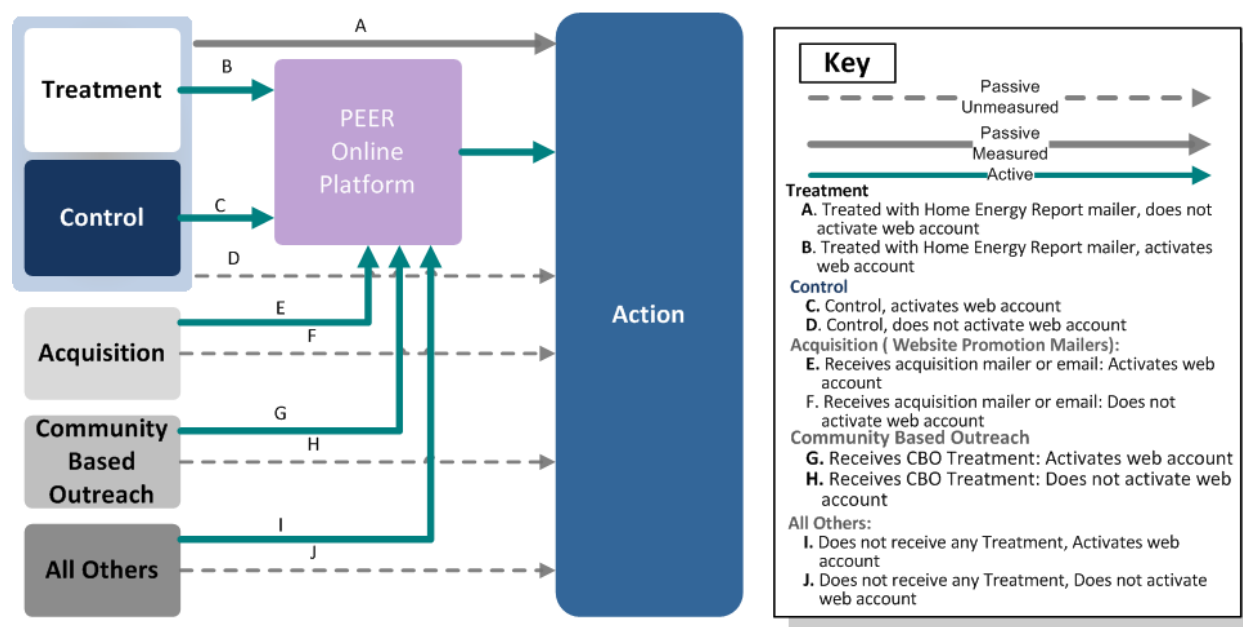
The HER program prompts energy savings through two primary paths: (1) educational reports; and (2) educational reports and customer interaction with their online platform. The home energy reports detail and benchmark customers' energy usage and against their past usage and similar homes in the area. Customers also have the option of opting-in to an online platform to gain greater feedback on their energy usage.

2.1.2 C3 Western Mass Saves Pilot (Opt-Out and Opt-In Model)

The Western Mass Saves pilot consists of two distinct elements: (1) an online web platform available to all WMECo customers; and (2) energy saving reports (mailers) distributed to targeted treatment customers. Customers who sign up for the website are considered "activated." Those who are treated with mailed reports, but do not engage with the online platform, are considered "passive" customers. In addition, the pilot uses community-based initiatives to help further drive participation in the program, though this is a minor portion of its work. This program targeted all WMECo customers.

The diagram below illustrates the paths to action for the C3 WMS ESR program.

Figure 4. C3 Participant Path Diagram



The WMS pilot has multiple paths to action. A select group of customers is assigned to treatment and control groups. The treatment group receives the C3 WMS ESR and can opt-in to the online platform (paths A and B). Notably, any customer can opt-in to the online platform including the control group (paths C-J), though certain customers receive mailers that promote the web portal or receive promotional treatment through community groups (paths E-H).

2.1.3 Cape Light Compact Smart Home Energy Monitoring Pilot

To participate in the Smart Home Energy Monitoring Pilot (SHEMP), Energize customers must be year-round residents of Cape Cod or Martha's Vineyard, have lived in their home for a year or more, have high-speed (always on) Internet connectivity, a free Ethernet port on their router, a power outlet near their router, and a power outlet within six feet of the electricity meter. Participation criteria for Legacy customers are the same, except that the power outlet needs to be immediately adjacent to the meter rather than six feet away.

Table 3. Comparison of Legacy and Energize-Treated Customers in SHEMP

Treatment Characteristic	Legacy	Energize
Qualifying	Looked for over 650 kilowatt hours (kWh) per month, representing average customer use.	Customers were not selected based on usage. Recruitment was open to all customers.
Recruitment	Ran a two-by-two advertisement in the Saturday paper. Information was also posted on the website, and had a Provincetown radio station to recruit.	A front-page story was put in the local paper, email blasts were sent to customers, newsletters were sent, and information was posted on the website. Information was also posted in local weekly papers where the story was picked up.
In-home display	No in-home displays were provided for the Legacy customers.	Customers have in-home displays that toggle between kWh and usage screens. The in-home display will accept push notifications.
Frequency of usage feedback	Customers receive usage feedback data at close to one-minute intervals that can be viewed online.	Customers receive 5-15 minute interval data displayed on the in-home display (IHD) as well as online.
Reporting	Customers can opt-in to weekly or daily email reporting from SHEMP.	Customers do not receive reports.
Web engagement	The Legacy pilot has an in-depth social networking function online where customers "share" images of their usage from the website and discuss learnings with other users.	Energize shares information and feedback related to usage and provides benchmarking against others with similar homes, with no social networking component. ¹²
Implementation	Provided feedback, manuals, and monthly reports. The pilot prompted customers to log-in and check their usage. Customers logged-in frequently.	Many Energize customers are not aware of the online portal and engagement. During the installation, many customers were not provided detailed information even though it was made available by Cape Light Compact.

¹² The vendor considered making the social networking component available to Energize participants, but it was not incorporated during the study timeframe.

2.2 KEY RESEARCH QUESTIONS

The purpose of this report is to address a set of overarching researchable issues the PAs tasked the Evaluation Team to assess for all behavioral programs and pilots in Massachusetts. The researchable issues in this integrated report focus on the impact findings from our impact analysis of the three programs and pilots conducted throughout Massachusetts in 2012. Below we detail the researchable issues covered in this report:

1. What are the energy savings impacts of these efforts? How do they differ by program/pilot type?
2. Do these programs/pilots lead to additional participation in other programs?
 - a. What energy savings are associated with cross-program participation?

2.3 STRUCTURE OF THE REPORT

This report combines multiple deliverables provided to the Massachusetts PAs throughout 2012. We provide a summary of each chapter below.

- **Chapter 3. Methodology:** Details the evaluation activities conducted for the 2012 Massachusetts Behavioral Programs and Pilots.
- **Chapter 4. Detailed OPOWER HER Programs Impact Findings:** Provides the impact results from the 2012 OPOWER HER programs administered by National Grid and NSTAR. These findings were delivered to support the 2012 annual report filings.
- **Chapter 5. OPOWER HER Programs Channeling Analysis Findings:** Provides the channeling results from the 2012 OPOWER HER programs administered by National Grid and NSTAR.
- **Chapter 6. C3 WMS Impact Findings:** Details the findings from the impact evaluation of WMECo's WMS program implemented by C3. This chapter includes regression-based impact evaluation of the WMS customers.
- **Chapter 7. CLC SEMP Process and Impact Findings:** Details the process and impact evaluations of Cape Light Compact's Smart Home Energy Monitoring Pilot.
- **Appendices:** Details findings to support Chapters 4-7 and corresponding data collection instruments used for this report.

3. METHODOLOGY

In this section, we detail the evaluation activities conducted for the 2012 Massachusetts Behavior/Feedback Programs and Pilots. Table 4 below provides a brief snapshot of the tasks conducted. We describe each method following the table.

Table 4. Data Collection and Analysis Efforts Conducted to Support This Report

Program	PA	Participant Database Review	Cross-Program Channeling Analysis	Impact Analysis
OPOWER HER Program	National Grid	Yes – all cohorts	Yes – all cohorts	Difference-in-differences (DID) linear fixed effects panel regression – all cohorts
OPOWER HER Program	NSTAR	Yes – all cohorts	Yes – all cohorts	DID linear fixed effects panel regression – all cohorts
C3 Western Mass Saves	WMECo	Yes – all cohorts	Yes – all cohorts	DID linear fixed effects panel regression; bias-corrected matching analysis
Smart Home Energy Monitoring Pilot	CLC	Yes – all cohorts	No, just participation lift review	Model 1 is regression analysis with pre-processing. Model 2 is bias-corrected matching analysis.

3.1 OPOWER HER PROGRAMS

3.1.1 Channeling Analysis

OPOWER report-based programs prompt a wide range of actions, including measure installations. For this reason, we would expect to see a lift in participation in other NGRID and NSTAR energy efficiency programs among participants—i.e., a higher rate of participation among the treatment group compared to the control group. Increased participation in other energy efficiency programs among participants suggests that some portion of savings from other programs may be counted by both the behavioral program (through the billing analysis savings estimates) and other utility programs (through deemed savings in their tracking databases). The purpose of a channeling analysis is to answer the following two questions:

- Does behavioral program treatment have an incremental effect on participation in other energy efficiency programs (**participation lift**)?
- What portion of savings from behavioral program treatment is double-counted by other energy efficiency programs (**savings adjustment**)?

We describe each below.

Participation Lift Analysis

To determine whether behavioral program treatment generates lift in other energy efficiency programs, we calculated whether more treatment than control group members initiated participation in other energy efficiency programs after the start of the behavioral program. We cross-referenced

the databases of the behavioral program—both treatment and control groups—with the databases of other residential energy efficiency programs available to the customer base targeted by the behavioral programs.

Programs for National Grid under evaluation include:

- Residential ENERGY STAR® Appliances
- Residential ENERGY STAR® HVAC
- Residential ENERGY STAR® Lighting
- Residential Multifamily
- Residential Conservation Service
- Residential Gas Heating and Water Heating
- Residential Weatherization
- Residential Low-Income Single Family

Programs for NSTAR under evaluation include:

- Residential ENERGY STAR® appliances
- Residential ENERGY STAR® HVAC
- Residential ENERGY STAR® Lighting
- Residential Multifamily
- Residential Conservation Service
- Residential High-Efficiency Heating Rebate
- Residential High-Efficiency Hot Water Equipment
- Residential ENERGY STAR Thermostat Rebate

Through this database crossing, we determined:

(1) Whether each program household participated in any program after the start of the behavioral program; and

(2) The date of first participation in each non-behavioral energy efficiency program.

Across programs, we calculated a participation rate for each program year, based on the number of accounts that initiated participation in any other energy efficiency program within the cycle per cohort after the first report date.^{13,14} This rate captures how many customers engaged a utility program after exposure to the behavioral program. The difference in treatment and control participation rates is participation lift. We also looked at participation rates in the year prior to the

¹³ HER control group members were assigned a “first Home Energy Report” date that aligns with the date of corresponding HER participants in the same cohort. The distribution of program start dates for each cohort is equivalent between treatment and control.

¹⁴ We used the first audit or installation date of each account that participated in a particular program to determine whether a household *initiated* participation in any program after the first HER.

behavioral program to ensure that there were no pre-existing differences in program participation rates between treatment and control.

Savings Adjustment

HER behavioral program participants can save energy directly—through conservation behaviors or measures installed outside of an energy efficiency program—and indirectly, through measures installed as part of other utility energy efficiency programs (channeling). Though indirect savings through other energy efficiency programs may not have occurred in the absence of the behavioral program (e.g., if the HER induces participation), these savings may still be counted by other programs. The objective of the savings adjustment component of channeling analysis is to determine what portion of HER net savings, as measured through the billing analysis, is captured in other program databases, and then to adjust HER net savings to reflect only direct savings obtained outside of other PA programs.

The starting point of savings adjustment analysis is HER program savings detected in billing analysis. Billing analysis models assume that treatment and control are equivalent on all dimensions except behavioral program treatment. However, because treatment and control rates of participation in other energy efficiency programs may not be equivalent (discussed above), it is possible that some portion of HER savings detected in billing analysis is not unique to the HER program. To estimate HER direct savings, we first estimated total HER net program savings from billing analysis. We then estimated HER net channeled savings as the difference between savings from other programs achieved by the HER participant group, compared with the control group, to further refine our net savings estimates. We calculated channeled savings from other energy efficiency programs in the first program year using the following approach:

- Identify deemed net savings from all measures installed by HER accounts *after* each account's first report date within the programs (within each program cycle);
- Identify deemed net savings from all measures installed by HER accounts *prior* to each account's first report date within the programs (matched to the post-data availability during each program cycle);
- Adjust annual deemed net savings for each measure installation in proportion to the number of days per year in which a measure was installed for both the treatment and control group in the pre- and post-period;
- Calculate average annual net savings from other programs as the average of the sum of savings for each HER account within each program cohort and treatment group (e.g., electric pilot cohort); and
- Conduct difference-of-differences pre-post/treatment-control to estimate the resulting incremental channeled savings gained by the treatment group in excess of the control group from the pre- to the post-treatment period.

Note that the Evaluation Team did not adjust for upstream lighting programs. Based on our survey research detailed in the 2010 Behavioral Report, Volume II, there was no indication that the HER program participants participated in upstream compact fluorescent lamp (CFL) programs

(determined by CFL installations) more than the control group. For this reason, the Evaluation Team did not adjust for upstream program savings in this analysis.¹⁵

The result of this database crossing and calculation is a HER channeled savings estimate, which can be subtracted from the estimate of total HER program savings. Note that these channeled savings could be attributed to both the HER and other utility programs, as they would not occur unless both programs were operating. For accounting purposes, only one program can claim these savings.

3.1.2 Impact Analysis: Linear Fixed Effects Regression

The Evaluation Team conducted a billing analysis to assess changes in energy consumption attributable to the HER programs. The Evaluation Team used linear fixed effects regression (LFER) analysis to estimate program effects. This approach is described below, where we emphasize that LFER analysis provides what is termed as a difference-in-difference (DID) estimate of program savings. This essentially compares the average change in energy consumption between pre- and post-periods among the treatment group to the average change in energy consumption between pre- and post-periods among the comparison group. This analysis assesses what participant consumption was after treatment compared to what it would have been in the absence of the program, i.e., the program net savings.

The DID approach takes advantage of the presence of a randomly assigned control group for each of the cohorts who received reports in the National Grid and NSTAR territories, and of the fact that we have multiple measures of energy consumption both pre- and post-participation. The fixed-effects modeling approach allows for the time-invariant, household-level factors affecting energy use to be accounted for without measuring those factors and entering them explicitly in the models. These factors are contained in a household-specific intercept, or constant term in the equation.

The simplest possible model to use to capture the effects of the treatment on participants, given the experimental design, is:

$$ADC_{it} = \alpha_i + \beta_1 Post_t + \beta_2 Treatment_i \cdot Post_t + \varepsilon_{it} \quad (\text{Equation 1})$$

Where:

ADC_{it} = Average daily consumption (kWh) for household i at time t

α_i = Household-specific intercept

β_1 = Coefficient for the change in consumption between pre- and post-periods

β_2 = Coefficient for the change in consumption for the treatment group in the post-period compared to the pre-period, and to the comparison group. This is the basis for the net savings estimate.

For all program cohorts, the simplest model was used because it is typically the most straightforward estimation of the effects of an experimental design, and because the weather variables are not necessary. In an experimental design, when the same months are present in the pre- versus post-treatment time periods, the weather is orthogonal to the treatment and the period.

¹⁵ Given that this study was performed in 2010, the results should be re-validated for the next program cycle.

3.1.3 Savings Estimate Ratio

One of the Evaluation Team's tasks was to create a Savings Estimate Ratio to apply to savings estimated by OPOWER so a full-scale LFER evaluation of savings each year can be avoided. Our approach to this task was to calculate a weighted ratio of the Evaluation Team-estimated savings divided by OPOWER-reported estimates, termed a Savings Estimate Ratio. Note that this is not a realization rate that is typically calculated using Technical Resource Manual (TRM) or planning assumptions (i.e. ex-ante estimates) as the basis for comparison (the denominator).

Methodology

The Savings Estimate Ratio is calculated by dividing the modeled savings estimated (kWh savings) by the Evaluation Team to those estimated by OPOWER (see Equation 2).

$$\text{Savings Estimate Ratio}_{u,ci,f} = \frac{\sum_{i=0}^3 \text{Estimated Modeled Savings}_{u,ci,f}}{\sum_{i=0}^3 \text{OPOWER Reported Savings}_{u,ci,f}} \quad (\text{Equation 2})$$

Where:

u is a given utility

c is a given cohort

i is a given time period

f is a given fuel type

Given that the Savings Estimate Ratio is dependent on estimated savings, which change each year of treatment, the ratio can also change for each year of treatment. As such, the Evaluation Team calculated the Savings Estimate Ratio for each year of treatment and then aggregated them to the cohort level (see Equation 3).

$$\text{Savings Estimate Ratio}_{u,f} = \frac{(\text{Estimated Modeled Savings}) = \sum_{i=0}^3 n * kWh \text{ Savings}_{u,ci,f}}{(\text{OPOWER Reported Savings}) = \sum_{i=0}^3 n * kWh \text{ Savings}_{u,ci,f}} \quad (\text{Equation 3})$$

Where:

n is the average number of participants in a given cohort

u is a given utility

c is a given cohort

i is a given time period

f is a given fuel type

Estimated Modeled Savings

The billing analysis estimates achieved savings (program effects) using a linear fixed effects regression (LFER) analysis (described in 3.1.2). This analysis assesses what participant consumption actually was after treatment compared to what it would have been in the absence of the program (i.e., program net savings).

OPOWER Reported Savings

The Evaluation Team used the per-cohort (by year and fuel type) savings as reported by OPOWER as the denominator of the ratio. OPOWER uses the LFER model to calculate impacts; however, the reported savings are calculated on a monthly basis. Given this, the Evaluation Team calculated program cycle savings by adding the weighted monthly savings (by participating household each month) for the program cycle (see Equation 4).

$$\text{Opower Reported Percent Savings}_{u,ci,f} = \frac{\text{Total Monthly Savings}_{u,c,i,f}}{\text{Total Total Monthly Usage}_{u,ci,f}} \times 100 \quad (\text{Equation 4})$$

Where:

u is a given utility

c is a given cohort

i is a given time period

f is a given fuel type

Note that the Evaluation Team included negative savings in the calculation for the program-level savings estimate. We also weighted the monthly percent savings by each month's usage so that, for example, the percent gas savings for a summer month was not weighted the same as a winter month. In addition, the estimated modeled savings were adjusted for channeling effects before being inserted into the Savings Estimate Ratio. This ratio then becomes the adjustment factor described in Chapter 4.

3.2 C3 WMS PROGRAM

3.2.1 Channeling Analysis

As noted previously, the purpose of a channeling analysis is to answer the following two questions:

- Does behavioral program treatment have an incremental effect on participation in other energy efficiency programs (**participation lift**)?
- What portion of savings from behavioral program treatment is double-counted by other energy efficiency programs (**savings adjustment**)?

The approaches used to address these questions are the same as those used for the OPOWER HER program, with one modification. While the application of the channeling analysis applied to the experimental design elements of the program (with treatment households compared to control households) generates estimates of participation lift and joint savings compared to a baseline of web access only (in which customers have the opportunity to activate the web portal), it leaves unaddressed the participation lift and joint savings for web access only compared to no program at all. These channeling effects are estimated by using the same analysis as in section 3.1.1, but where the reference population is matched comparison customers.

The programs for which the channeling analysis is conducted are the following:

- Refrigerator/Freezer Recycling Rebate

- Mass Save
- Multifamily
- ENERGY STAR® Heating and Cooling

3.2.2 Impact Analysis

Similar to the OPOWER HER programs, the Evaluation Team used linear fixed effects regression (LFER) analysis to estimate WMS program effects.

Evaluation of the 2012 WMS program savings can be partitioned into the evaluation of three groups of customers:

- “Initial Wave”: Customers in an initial randomized controlled trial (RCT) in which those customers assigned to the treatment group received ESRs beginning in November 2010. Both treatment and control customers were able to access the web portal.
- “Expansion Wave”: Customers in a second randomized controlled trial in which those customers assigned to the treatment group and who *did not* activate the web portal prior to July 2012 received a single mailed energy report in July 2012. Both treatment and control customers were able to access the web portal, but only the treatment customers were encouraged to activate the web portal through the mailed report. Notably, this single mailed energy report was for experimentation rather than savings.
- “Online Activations (no reports)”: Other WMECO customers who were not in the randomized controlled trials but who did activate the web portal.

Synopsis of Conceptual Approach to Estimate Savings

The following is a brief synopsis of the conceptual approach to estimating 2012 program savings for each of these three groups.

Initial Wave

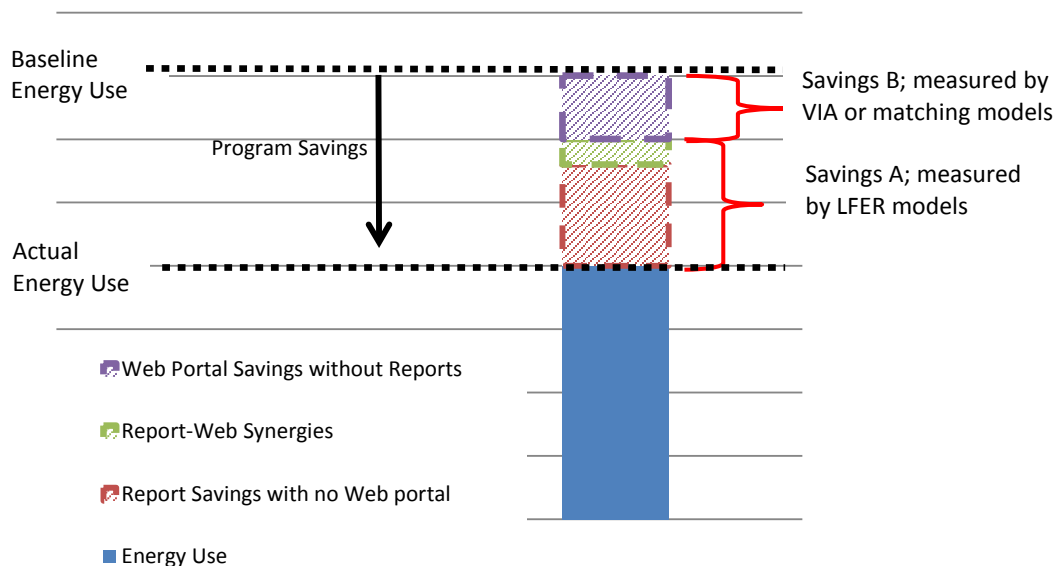
The estimation of 2012 program savings for Initial Wave customers (hereafter “initial customers”) proceeded in three steps:

1. A linear fixed effects regression (LFER) analysis, taking the same form as in Equation 1 in Section 3.1, involving a comparison of treatment and control households. This provides an estimate of the program savings effect of the opt-out and opt-in portions of the program *compared to a counterfactual in which the program has only the opt-in online/web portion*. This portion of program savings is illustrated in Figure 5 as savings amount A. It includes savings due to the ESR in the absence of access to the web portal (passive savings), and synergistic savings due to interactions between the web portal and the ESR, such as the fact that the ESRs steer households to the web portal (savings above standard, non-report activated savings).
2. To obtain total program savings, the savings value A must be incremented by the average savings to both treatment and control households due to the opt-in portion alone. Estimating these savings requires additional regression analysis, applied only to customers *that do not* receive ESRs. Two analysis methods were considered: (1) a variation in adoption (VIA)

method, and (2) a matching method, as described in detail below. The analysis generates Savings B in Figure 5.

3. Total 2012 unadjusted savings for the initial customers is the sum of Savings B and Savings A.
4. The savings adjustment discussed in Section 3.1 is subtracted from total savings to get total savings net of double-counted savings.

Figure 5. Illustration of Program Energy Savings



Expansion Wave

Unlike the Initial Wave, customers in the Expansion Wave (hereafter, “expansion customers”) were able to activate the web portal before selected report treatment households received the mailer. Importantly from an evaluation perspective, households categorized as treatment households that activated the web portal before the month the mailer was released, July 2012, *did not receive the mailer*. Consequently, the estimate of savings for this group took the following steps:

- a. After eliminating all customers who activated online through the web portal before July 2012, an LFER analysis, taking the same form as in Equation 1 in Section 3.1, was conducted to estimate the effect of receiving the mailer and having access to the web portal (conditional on not activating before the mailer is delivered) against a counterfactual of having access to the web portal only.
- b. Two methods—the VIA method and a matching method—were considered for estimating the 2012 savings by expansion customers who activated the web portal.
- c. The incremental savings by customers who received the mailer that arise because both the treatment group and the control group have access to the web portal after mailers are sent—Savings B in Figure 5—were *not* estimated due to low sample sizes. These savings would be based on the savings generated by expansion control customers who activated the web portal in the period, August 2012 to December 2012. There were only 48 such customers, too few to provide a reliable estimate. Instead, the savings by treatment customers who activated after receiving a mailer were included in the calculation of savings in Step b. This

implies a likely (very small) double-counting of savings, because at least some of these savings would already be captured by the LFER analysis of Step a.

- d. Savings adjustment to account for double-counting of savings with EE programs.

Online Activations (No Report)

As with the other two groups, two methods were considered for estimating the savings from activating the web portal: the VIA method and a matching method. Savings were adjusted to account for double-counting of savings with EE programs.

Verification of the Experimental Design

Statistical analysis can be used to determine whether the assignment of customers to the treatment and control groups is consistent with a randomized controlled trial (RCT). The analysis involves comparing the average energy use of treatment and control customers in the pre-program year. Under the assumption of an RCT, and at the 90% confidence level, we would expect that for each wave, chance alone would yield a statistical difference in mean consumption between the treatment and control groups for zero to two months of the pre-program year.

Estimation of Savings Due to Activation of the Web Portal

Two analysis approaches were considered to estimate Savings B in Figure 5, the savings due to the web portal access compared to no program at all. The first is the variation in adoption (VIA) method developed by Harding and Hsiaw (2011).¹⁶ The second is a matching method with bias correction (see, for instance, Imbens and Woolridge (2009),¹⁷ and Abadie and Imbens (2011)).¹⁸ We describe the two methods below. **The VIA method performed poorly, in the sense that a statistical test of the maintained assumptions of the model indicated that the assumptions were violated, and so the estimates of savings reported in the Results section are based on the matching method.**

VIA Approach

The VIA regression model casts monthly electricity consumption as a function of a household-specific fixed effect, month/year fixed effects, and the time-distance from activation (both pre-activation and post-activation). This is a two-way fixed effects model that accounts for all time-invariant customer characteristics, and all month/year factors affecting all customers (such as weather and the inflation rate). Formally we have:

Model 1

$$ADU_{kt} = \alpha_k + \beta_t + \sum_{j=-\bar{m}}^{\bar{m}} \gamma_j D_{kt}^j + \varepsilon_{kt}$$

Where:

¹⁶ Harding, M. and Hsiaw, A. "Goal Setting and Energy Efficiency", draft manuscript, 2011.

¹⁷ Imbens, G.W. and Woolridge, J.M. "Recent Developments in the Econometrics of Program Evaluation", *Journal of Economic Literature* 47(2009), 5-86.

¹⁸ Abadie, A. and Imbens, G.W. "Bias-corrected matching estimators for average treatment effects." *Journal of Business & Economic Statistics* 29.1 (2011): 1-11.

ADU_{kt}	=	Average daily energy use by household k in month t
α_i	=	Household-specific constant (fixed effect)
β_t	=	Month/year specific constant (fixed effect)
D_{kt}^j	=	A 0/1 indicator variable, taking a value of 1 if month t is the j^{th} month before/after household k activates the web portal
γ_j	=	Coefficient on the indicator variable D_{kt}^j
ε_{kt}	=	Model error term

Average customer program savings/day are the estimates of the coefficients γ_j . A statistical test on the coefficients γ_j for the period *before* the start of the program (i.e., $j=-m, -m+1, \dots, -1$) is a test of the maintained assumptions of the model. If the model assumptions are correct, we do not expect that savings before activation will be statistically different than zero, because the customer has not yet opted into the program.

Matching Method

The matching method follows the approach summarized in Imbens and Woolridge (2009) and applied in Abadie and Imbens (2011). In this model, the effect of the activation in month t is the difference between the energy use of participant k and its estimated counterfactual (baseline) consumption. The estimated counterfactual consumption is the average consumption of its matched household amended with a “bias adjustment” to reflect differences in energy use between participants and their matches during the matching period. The model is used to estimate program effects of the Cape Light Compact Smart Home Energy Monitoring Pilot, and is described as “Model 2” in Section 3.3.4. A minor difference between the estimation of the model used in this analysis and the one described in Section 3.3.4 is that dummy variables for participation in energy efficiency programs are not included in the model. Instead, double-counting of savings due to differential 2012 participation of activators and their matches in EE programs is addressed using the channeling analysis described in Section 3.1.1.

3.3 CAPE LIGHT COMPACT SMART HOME ENERGY MONITORING PILOT

3.3.1 Literature Review

We conducted a literature review in September 2012 to provide CLC with a high-level view of the current landscape of enhanced feedback programs, specifically the varying energy impacts of different **tools and tactics** of in-home feedback.

- **Tactics.** Customer outreach tactics include how customers are selected to participate in the program (e.g., opt-in versus opt-out deployment), as well as customer targeting and segmentation.
- **Tools.** Customer outreach tools include the delivery mechanisms in which customers interact with the program, as well as the feedback content in which information is provided to

achieve the greatest impact on customers' behavior. The mechanisms by which customers engage with the programs include frequency of information provided to customers (i.e., real-time feedback down to weekly updates) as well as mail, email, online portals, and in-home displays. The feedback methods where information is provided include personal savings plans, social engagement, competitions and comparisons, energy savings tips, and program channeling.

Appendix H details findings from 21 in-home display and enhanced feedback programs¹⁹ conducted in the United States from 2004 to 2012. Note that this is not a comprehensive list of all programs that have existed²⁰; these programs have been chosen to reflect the variety of implementation strategies, research methodologies, and resulting savings for the different types of feedback provided through these programs.

3.3.2 Process Analysis: Survey Research

The Evaluation Team conducted three behavioral surveys that are discussed throughout this report for the **Energyize-only cohort**. The primary roles of the behavior change survey research were: (1) to determine what actions participants report taking as compared to the pre-period; (2) to determine the proportion of actions that are reported to be equipment-based versus conservation behavior-based; and (3) to assess specifically which behaviors are contributing to pilot savings.

We designed the survey to allow comparisons between participant and control group members or their pre-period, regarding reported actions and behaviors taken in the year following first exposure to the behavioral pilot. Key questions included:

- Energy efficiency and conservation behaviors, including:
 - High-cost actions (such as appliances or envelope measures)
 - Low-cost actions (such as installing CFLs or SmartStrips)
 - No-cost actions (such as unplugging appliances, turning off lights)
 - Equipment maintenance and upkeep (such as HVAC tune-ups)
 - Participation in rebate or other non-behavioral programs (including audits)
- Demographic and household characteristics
- Engagement with pilot reports (if participant)

The survey was designed to understand differences in energy efficiency and conservation behaviors among participants, compared with control group members, based on participant exposure to the pilots. Therefore, the survey screened for recall to ensure that we spoke with household members who (a) were exposed to their report (based on their recall of the report), and (b) could provide some feedback related to the report (to ensure completion of process-related questions).

¹⁹ “Enhanced feedback” refers to the broad umbrella of behavioral programs that provide customers with additional details about their usage beyond the information included in their monthly bills.

²⁰ Additional reviewed programs that are not described in-depth in the literature review are provided in the “Further Reading” section at the end of this document. Feedback studies have been conducted since the 1960s and span three continents, but were excluded in the interests of providing the most current, locally relevant program information.

For this survey, we first asked all respondents if they had certain equipment in their home and regularly performed certain behaviors. Next, we asked all respondents if they installed any equipment or changed any behaviors in the past year. Then we asked about many specific actions and behaviors. The figures below detail the survey's logic.

Figure 6. Behavioral Survey Logic – Measures

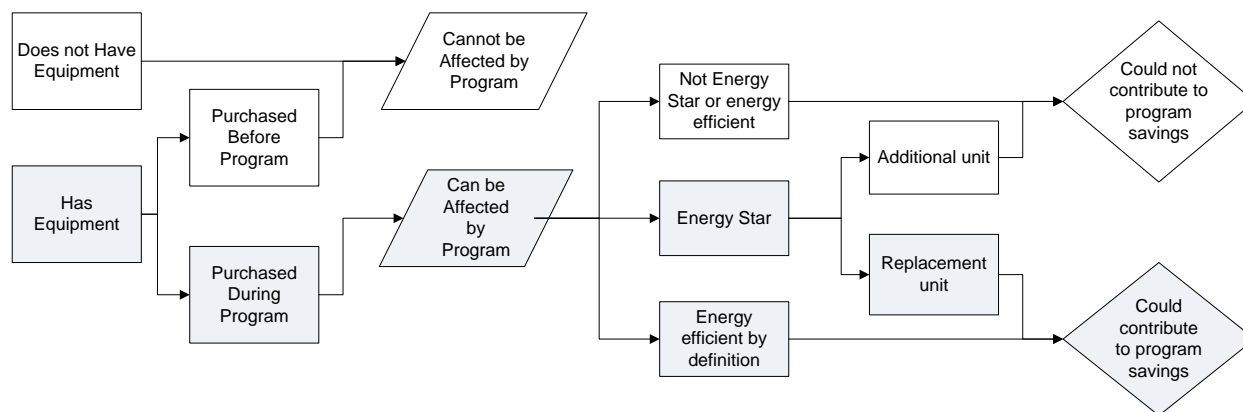
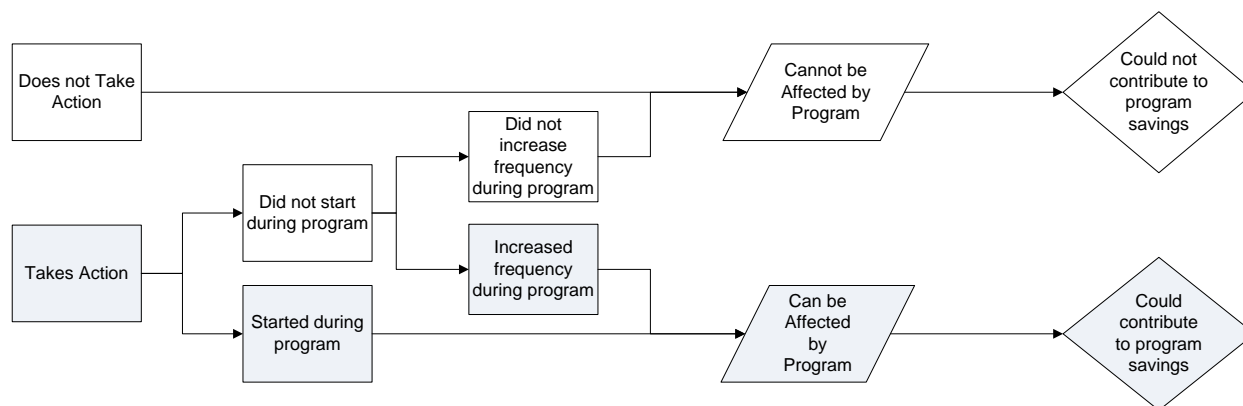


Figure 7. Behavioral Survey Logic – Behaviors



Pre-Post Interviews

We first interviewed customers in August through September 2011, prior to the pilot launch, and then again in November through December 2012, one year after treatment began. The initial, pre-treatment survey was conducted with SEMP Energize customers scheduled to receive the Energize pilot. Customers were surveyed prior to receiving treatment and after treatment. Seventy-seven (77) total customers completed both survey efforts.

Because this analysis was on a panel of customers, quotas were not applied.

Post Survey with Comparison Group

In addition to conducting a pre-post analysis, Opinion Dynamics conducted 54 interviews with Energize respondents' matched comparison group households. These households were used to measure psychographic differences between the two groups to be used in an instrumental variable approach. Ultimately, the instrumental variable approach was not used for the impact evaluation.

3.3.3 Participation Analysis

To determine whether behavioral pilot treatment generates lift in other energy efficiency programs, we calculated whether more treatment than control group members initiated participation in other energy efficiency programs after the start of the behavioral pilot. We cross-referenced the databases of the behavioral pilot—both treatment and comparison groups—with the databases of other residential energy efficiency programs available to the customer base targeted by the behavioral pilots.

Through this database crossing, we determined (1) whether each pilot household participated in any program after the start of the behavioral pilot; and (2) the date of first participation in each non-behavioral energy efficiency program. The findings from this analysis are demonstrated in charts in Chapter 7.

3.3.4 Impact Analysis

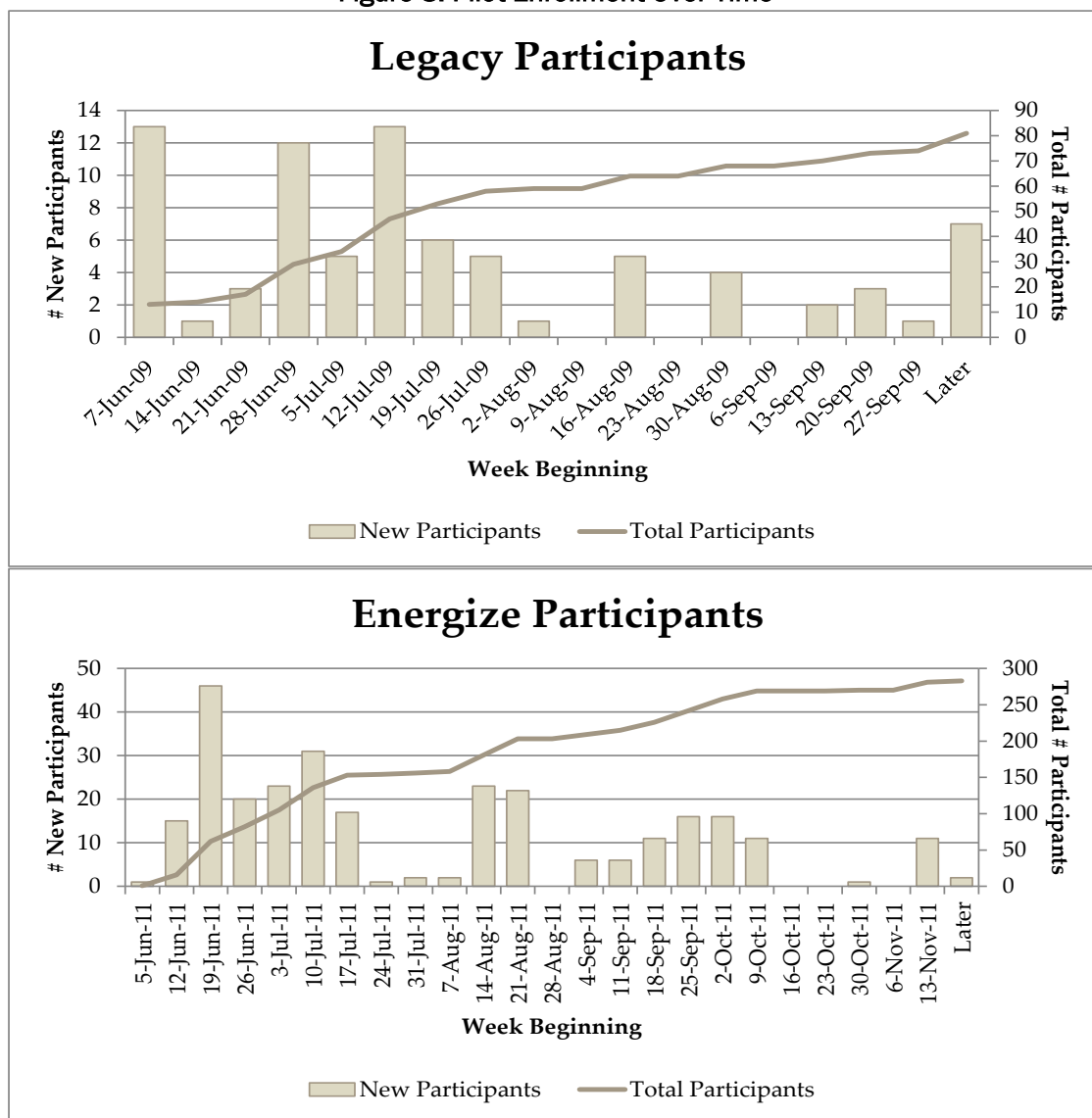
Customers Examined

SHEMP is an opt-in pilot involving two groups of customers: (1) Legacy households (N=83 in the analysis) that entered the pilot on the iCES platform during the period of June 9 through October 2, 2009²¹ and remain on this platform; and (2) “Energize” households (N=277 in the analysis) that entered the pilot on the Energize platform during the period of June 7 through November 19, 2011.²² Figure 8 displays the pilot enrollment for the Legacy and Energize participants over time.

²¹ Seven Legacy households entered the program in 2010.

²² Two Energize households entered the program after November 2011.

Figure 8. Pilot Enrollment Over Time



Because the pilot is opt-in and most customers in each of the two participant groups (Legacy and Energize) enrolled in the pilot over a relatively short time span—most within four months—estimates of pilot savings rely on matched non-pilot comparison customers whose energy use provides a baseline against which the energy use of pilot participants is compared. In other words, the comparison group is treated as providing the “counterfactual” energy use of pilot households—the energy use of pilot households were they not enrolled in the pilot.²³ The next section presents the models used in the analysis. The following section then discusses the selection of the matched comparison households used in the models.

²³ Given that customers were not randomly assigned to treatment and control conditions, we cannot be certain that the matched comparison group exactly represents the counterfactual, although we believe that we come close to that using the method of matching described.

Models Used in the Impact Analysis

Two models are used in the impact analysis, each estimated separately for Energize and Legacy customers. The first follows the approach of Stewart (2010), who essentially argues that matching a comparison group to the treatment group is a useful “pre-processing” step in a regression analysis to assure that the distributions of the covariates (i.e., the explanatory variables on which the output variable depends) for the treatment group are the same as those for the comparison group that provides the baseline measure of the output variable.²⁴ This minimizes the possibility of model specification bias. The regression model is applied only to the post-treatment period, and the matching focuses on those variables expected to have the greatest impact on the output variable.

As described in the next section, we matched participant and comparison customers on energy use during the pre-treatment period, and then estimated the following model:

Model 1

$$kWh_{kt} = \alpha_{0t} + \alpha_1 Treatment_{kt} + \alpha_2 PREkWh_{kt} + \sum_{j=1}^J \beta^j EE_{kt}^j + \varepsilon_{kt}$$

Where:

kWh_{kt} is the average daily electricity use by household k during month t

All Greek characters denote coefficients to be estimated, and in particular α_{0t} is a monthly fixed effect

$Treatment_{kt}$ is an indicator variable taking a value of 1 if customer k is a SEMP participant, and 0 otherwise²⁵

$PREkWh_{kt}$ is the average daily electricity use by household k during the most recent month before household k enrolled in SEMP that is also the same calendar month as month t . For instance, if household k enrolled in August 2011, the value of $PREkWh_{kt}$ for June 2012 is June 2011.

EE_{kt}^j is an indicator variable for energy efficiency program j , taking a value of 1 if customer k is in the program in period t and 0 otherwise. In the analysis we consider four EE programs (that is, $J=4$), denoted by the following variables in regression results reported in Appendix L:

LISF= Low Income Single Family program

MFR= Multi-Family Retrofit program

RHE= Residential Home Energy program

RP= Residential Products program

ε_{kt} is the error term

²⁴ Stuart, E.A. “Matching Methods for Causal Inference: A Review and a Look Forward.” *Statistical Science*, 25(1), February 2010, 1-21.

²⁵ If program enrollment occurred during a bill cycle, the current bill cycle is not coded as the post-period, and the following bill cycle will be the first post-period observation.

In this model α_1 indicates average daily savings generated by the program for participants over the course of the initiative.

The second model follows the approach summarized in Imbens and Woolridge (2008) and applied in Abadie and Imbens (2011).²⁶ In this model, the effect of the program in month t is the difference between the energy use of participant k and its estimated counterfactual (baseline) consumption. The estimated counterfactual consumption is the average consumption of its matched household amended to reflect differences between participants and their matches in the covariates X affecting energy use. Formally we have:

Model 2

$$Savings_{kt} = kWh_{kt} - \widehat{kWh}_{kt}^C$$

$$\widehat{kWh}_{kt}^C = kWh_{kt}^M + \hat{\beta}(X_{kt} - X_{kt}^M)$$

Where:

kWh_{kt} = The average daily electricity use by household k during month t

\widehat{kWh}_{kt}^C = The estimated counterfactual energy use by household k during month t

kWh_{kt}^M = The energy use by household k 's match during month t

X_{kt} = The values for household k in month t of the independent variables X affecting energy use

X_{kt}^M = The values of X in month t for household k 's match

$\hat{\beta}$ = The factors used to adjust household k 's energy use to reflect differences between household k and its match in the value of X

Following Abadie and Imbens (2011), the values of the adjustment factors $\hat{\beta}$ used in Model 2 are derived from a regression model applied to the post-program period, estimated using *only* the matched comparison households. In the current analysis the regression model used for adjustment purposes is identical to Model 1, except that the variable *Treatment* is excised, as the model is applied only to the matched comparison households. Formally:

$$kWh_{kt} = \alpha_{0t} + \alpha_2 PREkWh_{kt} + \sum_{j=1}^4 \beta^j EE_{kt}^j + \varepsilon_{kt} ,$$

where the energy efficiency programs EE^j included in the analysis are the same four used in Model 1.

The regression estimates used in Model 2 are $\hat{\gamma} = \{\hat{\alpha}_2, \hat{\beta}^1, \hat{\beta}^2, \hat{\beta}^3, \hat{\beta}^4\}$

²⁶ Imbens, G.W. and Woolridge, J.M. "Recent Developments in the Econometrics of Program Evaluation." *Journal of Economic Literature* 47 (2009), 5-86.

Abadie, A, and Imbens, G.W. "Bias-corrected matching estimators for average treatment effects." *Journal of Business & Economic Statistics* 29.1 (2011): 1-11.

Selecting Matched Comparison Households

In the analysis approach presented above, whether the estimate of savings is accurate—statistically speaking, efficient and unbiased—depends on selecting comparison households that accurately represent the counterfactual behavior of pilot participants. We take the perspective that the best matches for pilot household k are those households whose monthly energy consumption during a period before household k 's enrollment in the pilot most closely matches household k 's consumption during the same period. The underlying logic is that households with energy consumption closely matched over an extended period demonstrate that they respond the same to the many exogenous factors—weather in particular—that drive energy consumption. A more detailed description of the comparison household selection is provided in Appendix I.

4. DETAILED OPOWER HER PROGRAMS IMPACT FINDINGS

In this chapter we summarize impact findings for all 16 OPOWER HER cohorts.²⁷ We use the term “adjusted net” to refer to the final net savings gained through the OPOWER programs. The adjusted net savings exclude savings gained through other programs.

The findings presented here were obtained using two methods: (1) linear fixed effects panel models (LFER) (billing analysis) and channeling analysis (cross program participation assessment). We used LFER models to estimate the overall savings associated with program treatment above the control group. However, these findings may double-count savings that were gained through other programs. For this reason, we use channeling analysis to estimate a Difference-of-Differences (DoD) savings value attributable to other programs. We use this to reduce the overall savings estimates gained in the LFER, as needed. This approach is described in greater detail in Section 3.1. Additionally, examining program savings year-over-year provides insight into the programs’ ability to generate persistent energy savings with continued treatment. Nine cohorts in this evaluation have been evaluated for at least two years; the Evaluation Team examined whether there is persistent in savings in both electric and gas programs.

4.1 WHAT ARE THE HER PROGRAM IMPACTS?

The section below shows the results from the impact analysis by fuel type, cohort and year for both National Grid and NSTAR. More detailed results can be found in Appendix A.

4.1.1 National Grid Electric Program Findings by Cohort

Of the total seven cohorts evaluated, four cohorts have been evaluated for at least two years. All four of these cohorts show increased savings from PY1 to PY2 and from PY2 to PY3, where applicable.²⁸ We can see that the OPOWER Group 2009 demonstrated savings in all program years, saving an average annual net savings of 1.61% per household in PY1, 2.06% in PY2 and 2.38% in PY3, indicating that savings are persisting and possibly growing over time. Similarly, OPOWER Group 2010, OPOWER Group 2010 Add and OPOWER Group 2011 show persisting and growing savings over time. Overall, National Grid’s electric programs have demonstrated an average adjusted net savings gain of 27% from PY1 to PY2, and 16% from PY2 to PY3 (see Figure 9).

National Grid’s customer targeting strategy was revised for the three new cohorts (OPOWER Group 2011 Add, OPOWER Group 2012 Dual Fuel and OPOWER Group 2012). Specifically all customers, not just those with high usage, were eligible for the program. As such, the observed baseline consumption for these customers is notably lower and we also observe slightly lower percent savings per household as compared to the other cohorts. Additionally, multi-family buildings were also

²⁷ One of the cohorts (OPOWER Group 2012 Dual Fuel) is a dual fuel cohort and the program impacts are separated into electric and gas savings.

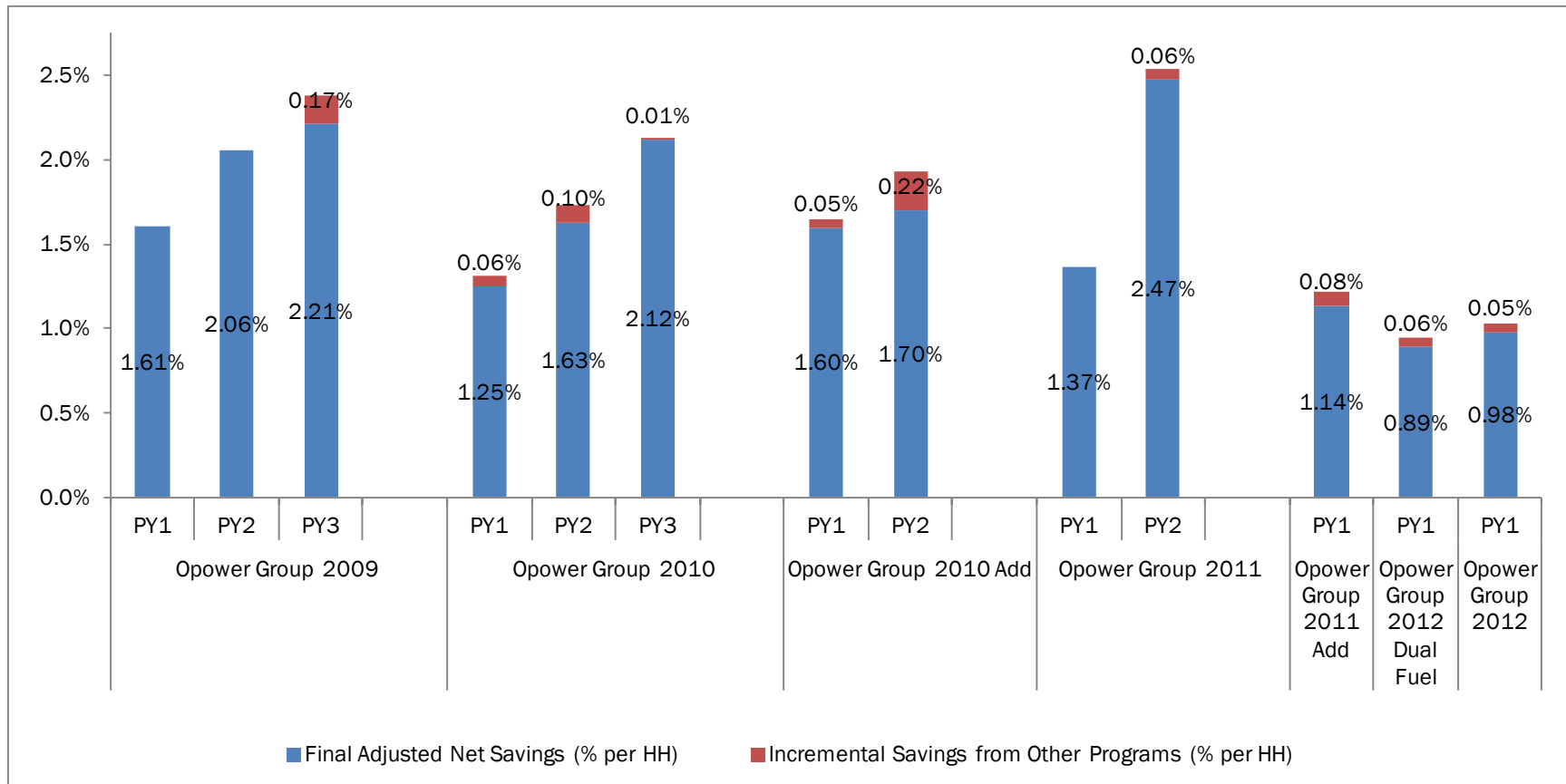
²⁸ PY1 refers first year of the program cycle, PY2 refers to the second year of the program cycle and PY3 refers to the third year of the program cycle. Each of PY1, PY2 and PY3 refer to each cohort’s program cycles, which are not always the same. Please refer to Table 2 for the program cycle start and end dates.

eligible for participation. This could also affect the percent savings as multi-family customers tend to, on average, save lower than single family customers (due to split incentives²⁹). See Appendix B for more detailed program descriptions and targeting practices.

The three new cohorts OPOWER Group 2011 Add, OPOWER Group 2012 Dual Fuel, and OPOWER Group 2012 all show positive savings in their first year of implementation. Detailed description of the impacts can be found in Appendix A. In addition to persisting and growing savings, the channeling analysis shows that the savings attributable to other programs (and thus those savings removed from the net impact savings) are also growing over time. This shows that OPOWER HER customers are engaged in saving energy outside of the OPOWER program and that the savings associated with these efforts are accumulating over time. More details about channeled savings are provided in Chapter 5.

²⁹ The channeling savings adjustment analysis accounts for all changes made by the participants, including installation of equipment, and not just behavioral changes. Given this, split incentives within multifamily building could affect the percent savings.

Figure 9. NGRID Electric Net Adjusted Savings by Cohort (% per HH)



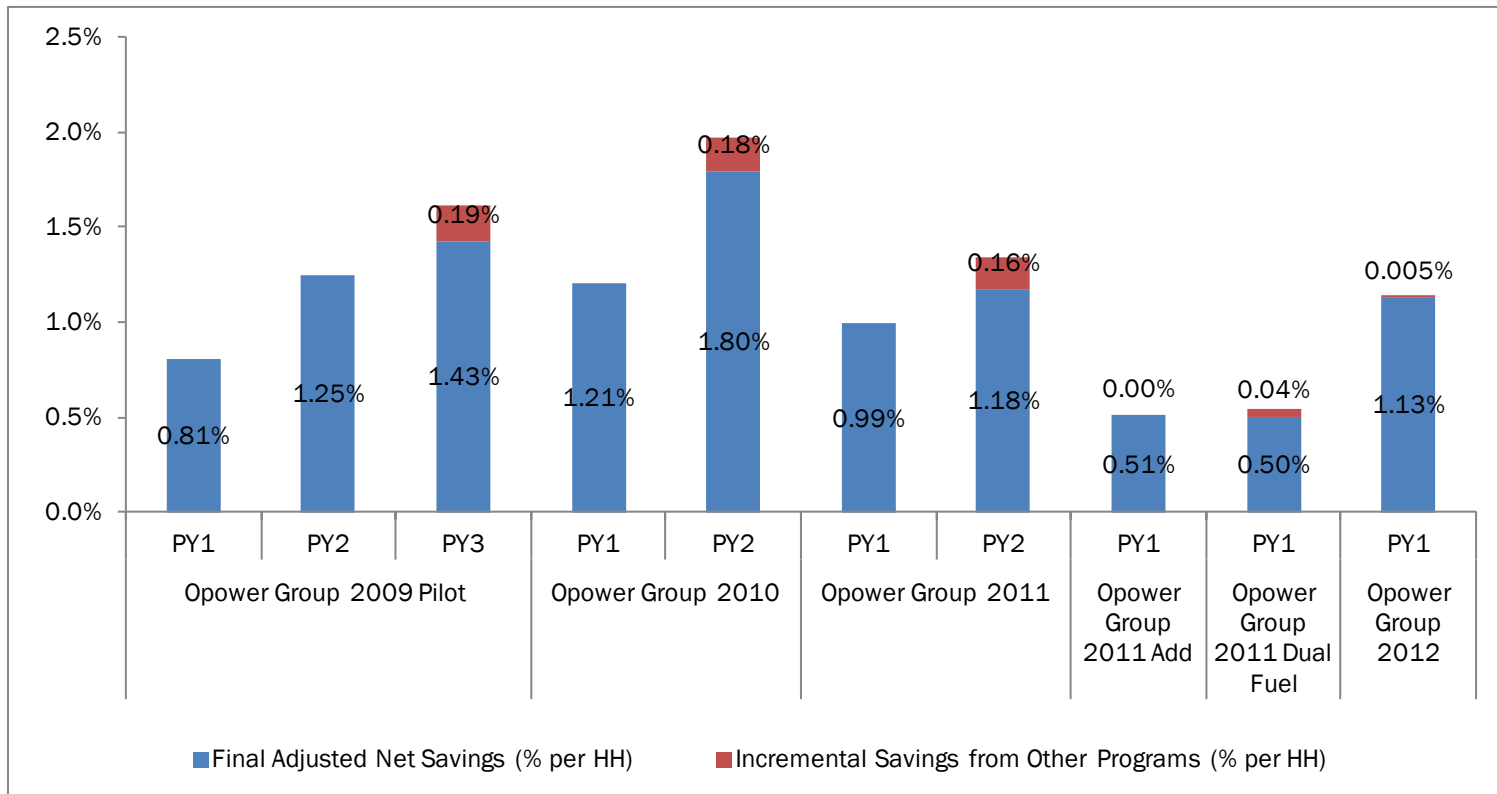
4.1.2 National Grid Gas Program Findings by Cohort

Of the total six cohorts evaluated, three cohorts have been evaluated for at least two years. All three of these cohorts show increased savings from PY1 to PY2 and from PY2 to PY3, where applicable. We can see that the OPOWER Group 2009 led to savings in all program years, saving an average annual net savings of 0.81% per household in PY1, 1.25% in PY2 and 1.62% in PY3, indicating that savings are persisting and possibly growing over time. Similarly, OPOWER Group 2010, and OPOWER Group 2011 show persisting and growing savings over time. Overall, National Grid's gas programs have demonstrated an average adjusted net savings gain of 20% from PY1 to PY2, and 23% from PY2 to PY3 (see Figure 10).

The three new cohorts OPOWER Group 2011 Add, OPOWER Group 2012 Dual Fuel, and OPOWER Group 2012 all show positive savings in their first year of implementation. Detailed description of the impacts can be found in Appendix A. Similar to NGRID's electric cohorts, the targeting of customers was modified for the these three new cohorts and the observed baseline consumption for these customers is notably lower. As such, we also observe slightly lower percent savings per household as compared to the other cohorts. Additionally, multi-family buildings were also eligible for participation. This could also affect the percent savings as multi-family customers tend to, on average, save lower than single family customers (due to split incentives). See Appendix B for more detailed program descriptions and targeting practices.

In addition to persisting and growing savings, the channeling analysis shows that the savings attributable to other programs (and thus those savings removed from the net impact savings) are also growing over time. This shows that OPOWER HER customers are engaged in savings energy outside of the OPOWER program. More details about channeled savings are provided in Chapter 5.

Figure 10. NGRID Gas Net Adjusted Savings by Cohort (% per HH)

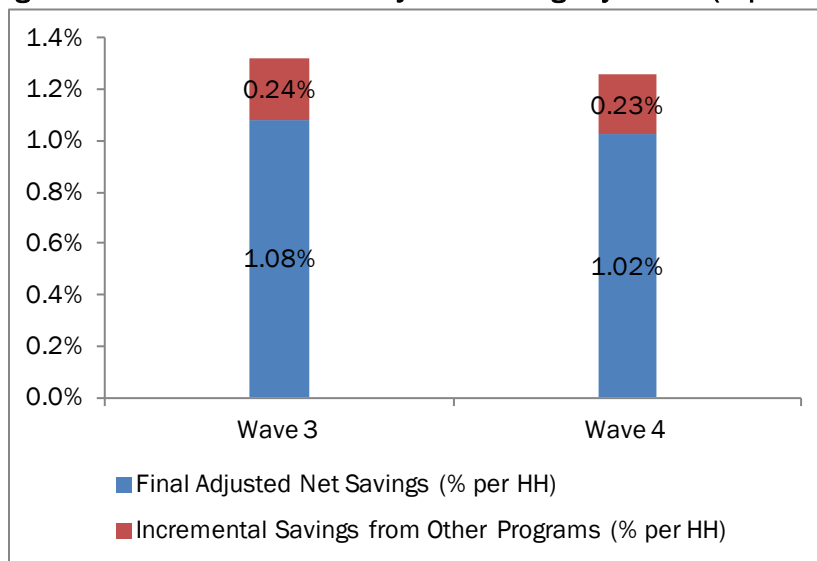


4.1.3 NSTAR Electric Program Findings by Cohort

NSTAR added two new cohorts into their electric program: (1) Wave 3 (first reports were sent beginning in March 2012); and (2) Wave 4 (first reports were sent starting in May 2012). Wave 3 led to an average annual net savings of 1.32% per household and Wave 4 led to average annual net savings of 1.25% per household (see Figure 11). Detailed description of the impacts can be found in Appendix A.

In PY1, we found that both Wave 3 and Wave 4 had statistically significant savings due to other programs in our channeling analysis. More details about channeled savings are provided in Chapter 5.

Figure 11. NSTAR Electric Net Adjusted Savings by Cohort (% per HH)



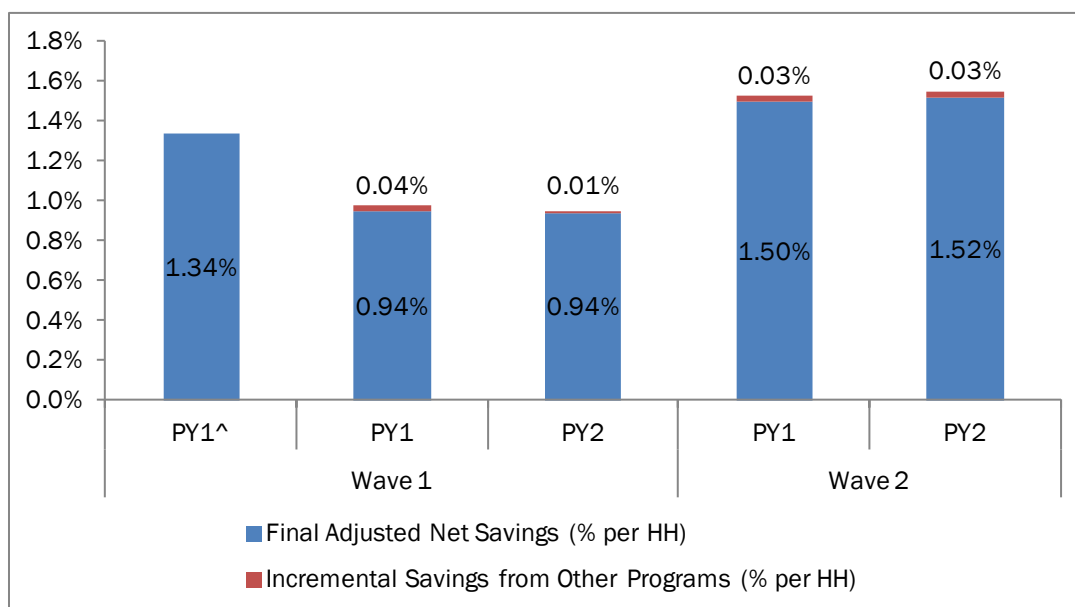
4.1.4 NSTAR Gas Program Findings by Cohort

Both of the NSTAR gas cohorts are in their second year of implementation. While both cohorts exhibit savings in PY2, Wave 1 led to an average annual net savings of 0.94% per household and Wave 2 led to average annual net savings of 1.52% per household. These cohorts did not see growing savings over time (see Figure 12). Rather we see that savings have stabilized over the second year of implementation. The reasons for this could be that gas cohorts in general tend to see savings stabilizing faster than electric cohorts (there are limited options for customers to save energy). The second reason could be that NSTAR targeting is different from that of the NGRID gas program; NSTAR has more multifamily buildings in their customer base. Research has shown that multifamily buildings tend to implement less energy savings changes due to split incentive barrier (since most are renters), and since many energy-saving measures are not available to renters or occupants of condominiums.

For gas programs, we see that the channeled savings have generally stabilized over the second year of implementation, indicating that gas customers might have limited options in terms of implementing energy savings changes. More details about channeled savings are provided in Chapter 5.

Detailed descriptions of the impacts can be found in Appendix A.

Figure 12. NSTAR Gas Net Adjusted Savings by Cohort (% per HH)



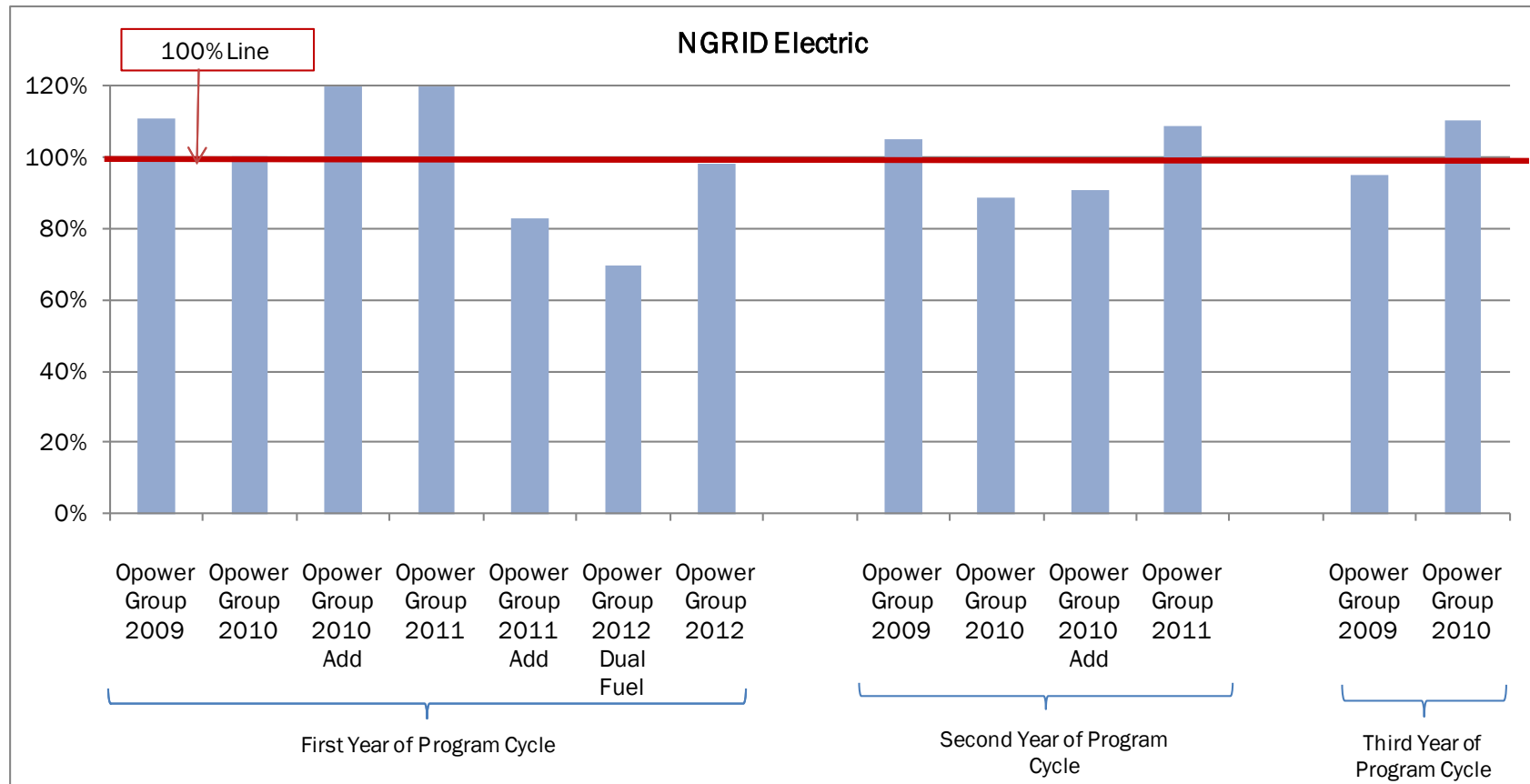
4.2 SAVINGS ESTIMATE RATIO ANALYSIS

As discussed in Section 3.1.3, the Savings Estimate Ratio for this evaluation is defined as the savings that is achieved by the program through the impact evaluation as compared to the savings calculated by the program implementer. This section discusses the findings based on the impact analysis and channeling analysis.

4.2.1 Observed Savings Estimate Ratio for Electric Cohorts

Figure 13 shows the Savings Estimate Ratio across the NGRID electric cohorts by their year of implementation. We can see that as cohorts go into their second or third year of implementation, the Savings Estimate Ratio stabilized around the 100% ratio line.

Figure 13. NGRID Electric Savings Estimate Ratio by Cohort



The observed Savings Estimate Ratio for NGRID electric cohorts, as calculated by applying the specification detailed in Section 3.1.3, show some variation across the cohorts and the program years (see Table 5).

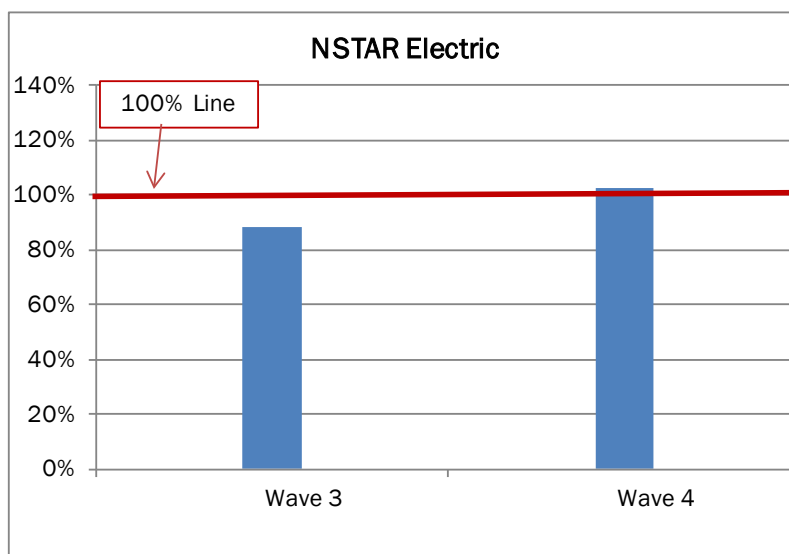
Table 5. Savings Estimate Ratio for NGRID Electric Cohorts

NGRID electric	PY1	PY2	PY3	Weighted Savings Estimate Ratio
OPOWER Group 2009	111%	105%	95%	105%
OPOWER Group 2010	100%	89%	111%	
OPOWER Group 2010 Add	167%	91%	NA	
OPOWER Group 2011	122%	109%	NA	
OPOWER Group 2011 Add	83%	NA	NA	
OPOWER Group 2012 Dual Fuel	70%	NA	NA	
OPOWER Group 2012	98%	NA	NA	

Notably, we do not see a consistent trend by year of treatment or by cohort. For this reason, we propose a cohort- and program year-neutral Savings Estimate Ratio. For the NGRID electric cohorts, we recommend using the weighted average Savings Estimate Ratio of 105%.

The NSTAR electric cohorts (see Figure 14) are both in their first year of implementation and thus have a slight variation in the Savings Estimate Ratio (see Table 6).

Figure 14. NSTAR Electric Savings Estimate Ratio by Cohort



The weighted average Savings Estimate Ratio for these two cohorts is 90%.

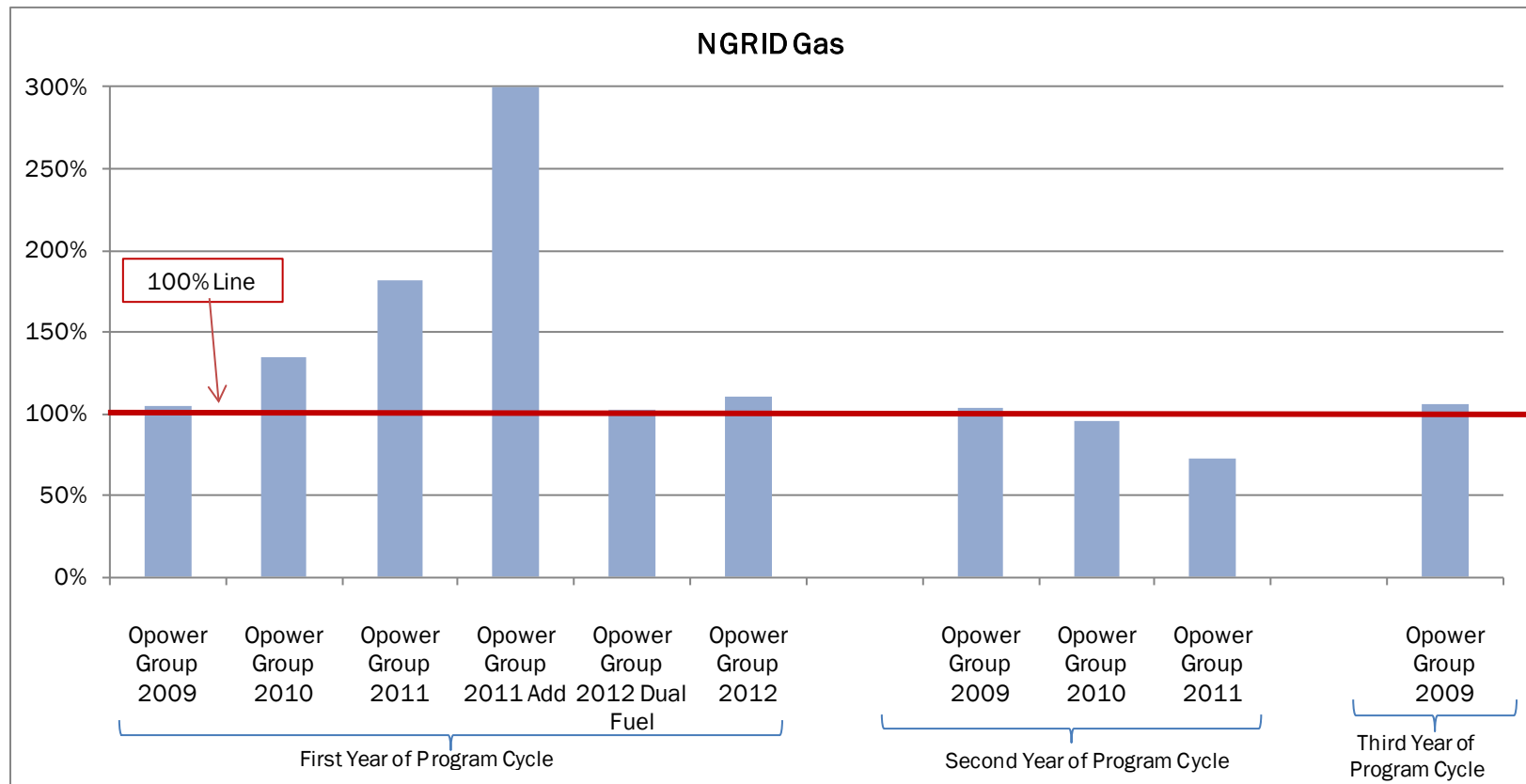
Table 6. Savings Estimate Ratio for NSTAR Electric Cohorts

NSTAR Electric	PY1	Weighted Savings Estimate Ratio
Wave 3	89%	90%
Wave 4	103%	

4.2.2 Observed Savings Estimate Ratio for Gas Cohorts

Figure 15 shows the Savings Estimate Ratio across the NGRID gas cohorts by their year of implementation. With the exception of one cohort (OPOWER Group 2011 Add), all cohorts have similar ratios as observed in the electric cohorts. The ratio for this particular cohort is significantly different. As noted before, the Evaluation Team included all negative savings when calculating the yearly savings for OPOWER reported savings, this may be the reason that this cohort shows net negative savings when incorporating all monthly values. Additionally, as can be seen in the graph, programs in their first year tend to have a greater variation in the ratio and get closer to the 100% ratio line in their second year. As such, it is expected that during the second program cycle, the estimates will be more aligned as we observe in the other cohorts.

Figure 15. NGRID Gas Savings Estimate Ratio by Cohort



The observed Savings Estimate Ratio for NGRID gas cohorts, as calculated by applying the specification detailed in Section 3.1.3, shows some variations across the cohorts and the years, with a much larger variation in the OPOWER Group 2011 Add (see Table 7).

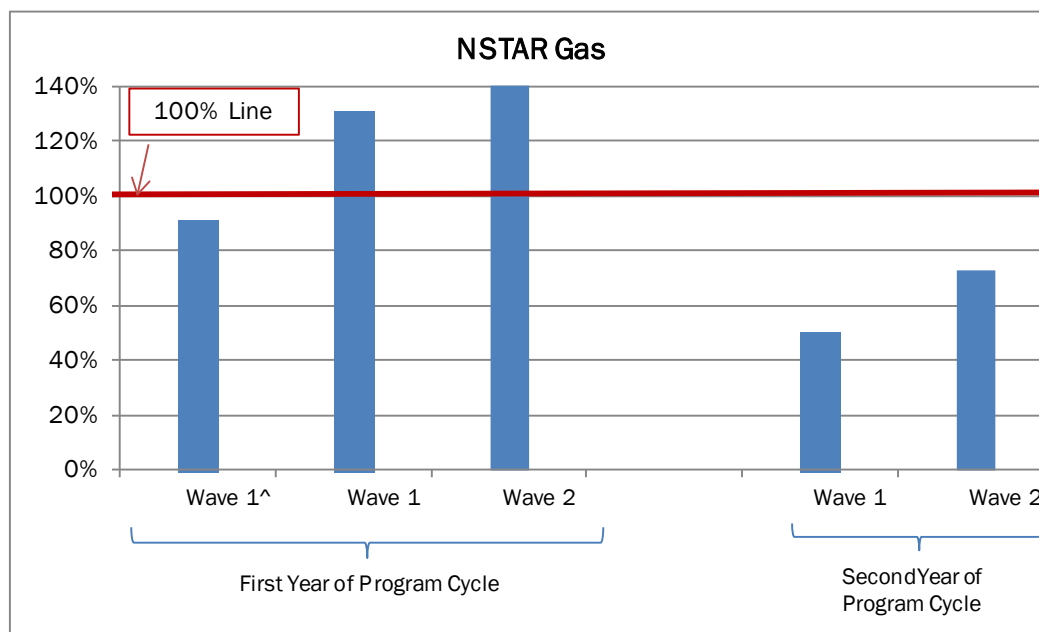
Table 7. Savings Estimate Ratio for NGRID Gas Cohorts

NGRID gas	PY1	PY2	PY3	Weighted Savings Estimate Ratio
OPOWER Group 2009	105%	104%	106%	111%
OPOWER Group 2010	135%	96%	NA	
OPOWER Group 2011	182%	72%	NA	
OPOWER Group 2011 Add	303%	NA	NA	
OPOWER Group 2012 Dual Fuel	102%	NA	NA	
OPOWER Group 2012	111%	NA	NA	

We recommend using the average Savings Estimate Ratio of 111% for the NGRID gas cohorts to adjust the OPOWER-based savings, with the same caution noted for electric savings.

The NSTAR gas cohorts (see Figure 16) are both in their second year of implementation and have some variation in the Savings Estimate Ratio.

Figure 16. NSTAR Gas Savings Estimate Ratio by Cohort



Note:

Wave 1^ is evaluation of the PY1 cycle from August 2010 through April 2011

Wave 1 is evaluation of the PY1 cycle from May 2011 through December 2011

Similar to NGRID gas, NSTAR gas cohorts show some variations across the program years and cohorts (see Table 8). We recommend using the average Savings Estimate Ratio of 97% for the NSTAR gas cohorts.

Table 8. Savings Estimate Ratio for NSTAR Gas Cohorts

NSTAR Gas	PY1^	PY1	PY2	Weighted Savings Estimate Ratio
Wave 1	91%	131%	50%	97%
Wave 2	NA	204%	73%	

Note:

PY1^ is evaluation of the PY1 cycle from August 2010 through April 2011

PY1 is evaluation of the PY1 cycle from May 2011 through December 2011

In summary, the following Savings Estimate Ratios are recommended for the NGRID and NSTAR electric and gas cohorts.

Table 9. Savings Estimate Ratios

	Savings Estimate Ratio
NGRID Electric	105%
NGRID Gas	111%
NSTAR Electric	90%
NSTAR Gas	97%

4.2.3 Application of the Savings Estimate Ratio

As describe before, the Savings Estimate Ratio will be applied to the savings estimated by OPOWER so that a full-scale LFER evaluation of savings each year can be avoided.

To be able to apply the ratio, it is important to note that the OPOWER estimate should be based on the same method that we used in this analysis. Specifically, all months should be used in the calculation, including months with negative savings. When calculating the annual estimate, monthly savings should be weighted by the average consumption for each month so that the percent savings over the year does not count summer months equally with winter months. Of course this is more important for gas cohorts than electric.

Once the OPOWER annual estimates are calculated, they should be multiplied by the Savings Estimate Ratio to calculate the total program savings. Next we provide a step-by-step methodology for applying the Savings Estimate Ratio and for calculating the overall program savings.

Step 1: Identify program cycle: Once the monthly data is received from OPOWER the appropriate program cycle time period should be identified (shown in bold in the example below).

Table 10. Example of Applying the Savings Estimate Ratio (Step 1)

A. Date Received from OPOWER			
Date	Percent Savings	Average Monthly Usage	Household
10/1/2010	-0.2%	1,000	10,000
11/1/2010	0.5%	900	10,500
12/1/2010	1.0%	800	10,200
1/1/2011	1.5%	1,000	11,000
2/1/2011	1.2%	1,500	10,900

A. Date Received from OPOWER			
Date	Percent Savings	Average Monthly Usage	Household
3/1/2011	1.3%	1,500	10,800
4/1/2011	1.8%	1,200	10,850
5/1/2011	2.0%	900	10,900
6/1/2011	2.0%	950	11,000
7/1/2011	0.5%	1,100	10,900
8/1/2011	0.6%	1,000	10,850
9/1/2011	1.2%	700	10,800
10/1/2011	-0.5%	900	10,750
11/1/2011	-0.2%	1,000	10,750
12/1/2011	0.5%	1,500	10,700

Note: These numbers are not real and are shown as an example

Step 2: Calculate total monthly usage and monthly savings within the program cycle. Using the Information given, the total monthly usage should be calculated by multiplying the average monthly usage with the household within that month (see column B in the table below). Next, the monthly savings should be calculated by multiplying the total monthly usage and the percent savings per month (see column C in the table below). Notably, savings for all months, including those with negative savings, should be calculated.

Table 11. Example of Applying the Savings Estimate Ratio (Step 2)

A. Date Received from OPOWER				B. Calculate Total Monthly Usage	C. Calculate Monthly Savings
Date	Percent Savings	Average Monthly Usage	Household	Monthly Usage * Household	Percent Savings * Total Monthly Usage
10/1/2010	-0.2%	1,000	10,000	10,000,000	(20,000)
11/1/2010	0.5%	900	10,500	9,450,000	47,250
12/1/2010	1.0%	800	10,200	8,160,000	81,600
1/1/2011	1.5%	1,000	11,000	11,000,000	165,000
2/1/2011	1.2%	1,500	10,900	16,350,000	196,200
3/1/2011	1.3%	1,500	10,800	16,200,000	210,600
4/1/2011	1.8%	1,200	10,850	13,020,000	234,360
5/1/2011	2.0%	900	10,900	9,810,000	196,200
6/1/2011	2.0%	950	11,000	10,450,000	209,000
7/1/2011	0.5%	1,100	10,900	11,990,000	59,950
8/1/2011	0.6%	1,000	10,850	10,850,000	65,100
9/1/2011	1.2%	700	10,800	7,560,000	90,720
10/1/2011	-0.5%	900	10,750	NA	NA
11/1/2011	-0.2%	1,000	10,750	NA	NA
12/1/2011	0.5%	1,500	10,700	NA	NA

Step 3: Calculate the total program cycle savings. The total program cycle savings are calculated by summing all the monthly savings (within the program cycle – i.e. Column C). In the example shown, the total program cycle savings would be 1,535,980 kWh.

Step 4: Multiply the total program cycle savings by the Savings Estimate Ratio. For this example, using a Savings Estimate Ratio of 105%, the adjusted cohort savings would be $(1,535,980 * 1.05) = 1,612,779$ kWh.

Step 5: Total program savings. Once each cohort's adjusted savings are calculated, they should be summed to get the overall program savings.

5. OPOWER HER PROGRAMS CHANNELING ANALYSIS FINDINGS

This section provides the results from the channeling analysis by fuel type, cohort, and year for both National Grid and NSTAR. More detailed results can be found in Appendix C and Appendix D.

5.1 DO BEHAVIORAL PROGRAMS LEAD TO PARTICIPATION AND SAVINGS IN OTHER PROGRAMS?

As part of this evaluation, our team examined the extent to which behavioral programs drive cross-program participation and lead to savings in other programs. Our research sought to answer the following questions: (1) what is the magnitude of cross-program participation savings? and (2) are the savings gained through other programs consistent across program, cohort, and jurisdiction?

To answer these questions, we combined all the program databases from residential National Grid and NSTAR programs, and matched the participants who participated in other programs with the participants who participated in the OPOWER HER behavioral programs. This allowed us to see which programs the OPOWER HER treatment and control groups participated in before and after receiving HER treatment. From this analysis, we derived the increase in participation and savings that were achieved through cross-program participation. To avoid double counting, we then subtracted this increase in savings already counted by other programs to determine the adjusted net savings impacts of the OPOWER programs (these values are presented throughout the report). (Note that this analysis was conducted separately for the C3 WMS efforts and is detailed in Chapter 7.)

5.1.1 Behavioral Programs Can Generate Cross-Program Participation, although the Effects Are Small

For this report, the Evaluation Team examined cross-program participation over all new program years for each of the HER cohorts. All cohorts exhibited participation lift except for one cohort that showed a decrease in participation. Where participation lift are statistically significant, the magnitude ranges between -0.2% – 1.94% (see Table 12).

Table 12. 2012 Participation Lift and Incremental Savings from Other Programs

Cohorts	2012 Participation Lift (%)	2012 Incremental Savings from Other Programs (% per HH)
NGRID Electric		
OPOWER Group 2009 (Electric)	0.36%	0.17%
OPOWER Group 2010 (Electric)	0.38%	0.01%
OPOWER Group 2010 Add (Electric)	0.94%	0.22%
OPOWER Group 2011 (Electric)	0.07%	0.06%
OPOWER Group 2011 Add (Electric)	0.14%	0.08%

Cohorts	2012 Participation Lift (%)	2012 Incremental Savings from Other Programs (% per HH)
OPOWER Group 2012 Dual Fuel*	0.30%	0.06%
OPOWER Group 2012 (Electric)	0.34%	0.05%
NGRID Gas		
OPOWER Group 2009 Pilot	1.35%	0.19%
OPOWER Group 2010	1.94%	0.18%
OPOWER Group 2011	1.04%	0.16%
OPOWER Group 2011 Add	0.33%	0.00%
OPOWER Group 2012 Dual Fuel*	NA	0.04%
OPOWER Group 2012	1.04%	0.005%
NSTAR Electric		
Wave 3	0.81%	0.24%
Wave 4	0.59%	0.23%
NSTAR Gas		
Wave 1	-0.20%	0.01%
Wave 2	0.21%	0.03%

* For the participation lift analysis, the Dual Fuel cohort was examined together for electric and gas customers.

One cohort (NSTAR Gas Wave 1) exhibited negative participation lift. This signifies that the control group had greater participation, from this cohort, than the treatment group. However, as noted in the section below, this group showed positive savings adjustment, which signifies that even though the control group participated in greater numbers, the energy savings changes adopted by the treatment group is slightly more significant in nature and led to higher savings (i.e. have a deeper affect).

5.1.2 Savings Associated with Other Programs Persist Year-Over-Year

It is important to note that the savings associated with cross-program participation will persist and likely grow year-over-year as participants engage in other programs. For this report, the Evaluation Team examined cross-program savings for all HER cohorts. To date, we have found statistically significant³⁰ savings associated with cross-program participation in 22 of the 30 program years (some cohorts have more than one year of implementation). Even where savings are statistically significant, the magnitude of these savings is quite small—representing between 0.005% and 0.24% average annual savings per household generated by the program.

The savings gained from other programs vary depending on three primary factors, including: (1) number of measures installed through participation in other programs; (2) the associated savings with those measures; and (3) differences in number one and number two in the pre-period versus

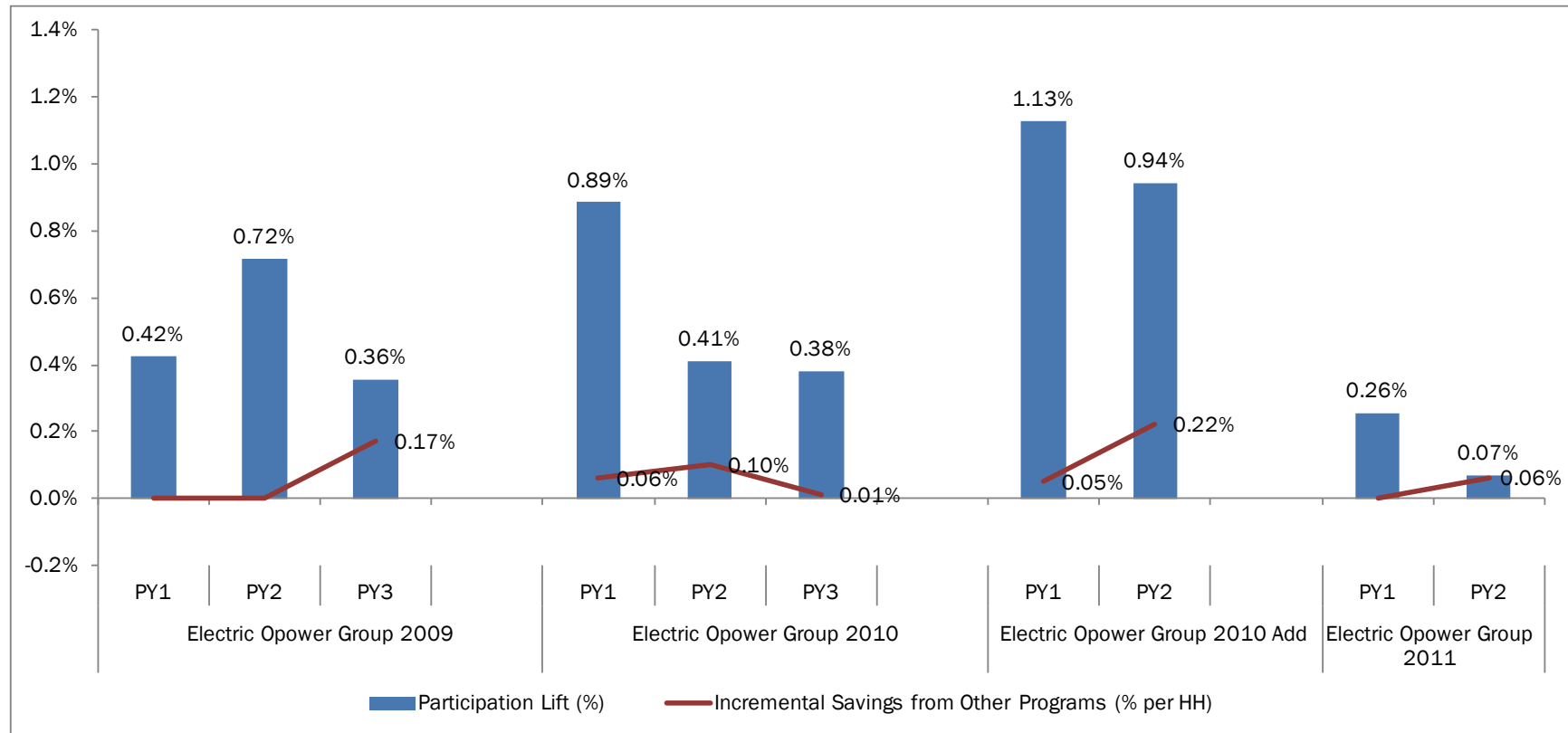
³⁰ We have followed the convention of calculating and using statistical significance as a basis for deciding whether a channeling effect was important enough to adjust for. This is in spite of the fact that standard errors and associated significance figures reflect sampling error, which we do not have in this evaluation. We are evaluating the effects of populations, so sampling error does not apply. All results should be interpreted with that in mind.

post-period among treatment and control groups. For example, treatment customers may participate in more programs, but install measures that generate fewer savings on average than those measures installed by the control group. In these cases, we see differences in participation, but not savings, as exemplified in Figure 17 below, where we see statistically significant increases in program participation yet no associated savings with this increase in participation.

Given that several cohorts are in their second or third year of implementation, the Evaluation Team examined whether both the participation lift and the savings associated with other programs were persisting at the same rate.

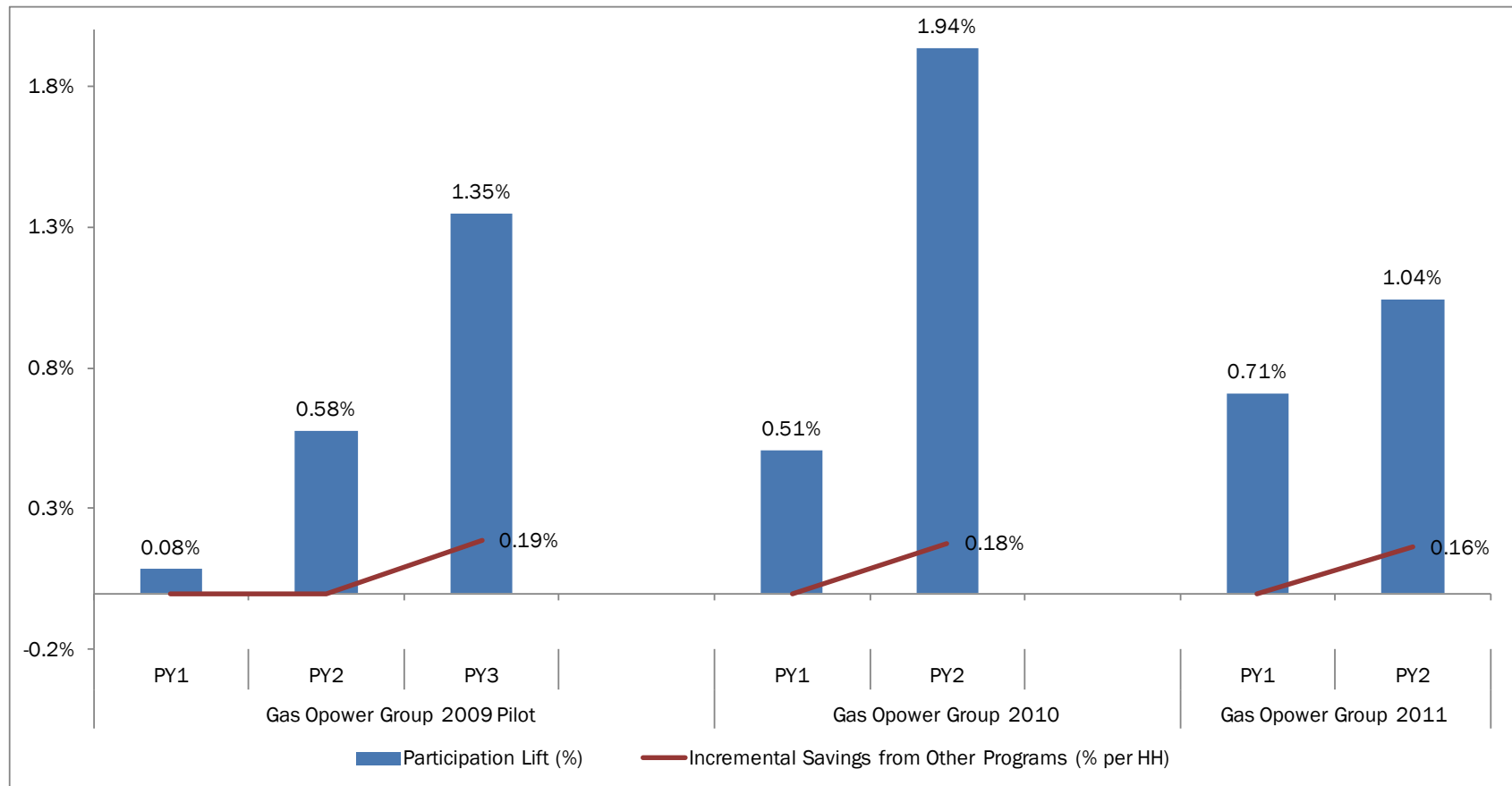
Figure 17 and Figure 18 show both the percent participation lift and the percent savings associated with other programs by cohort and by year. We can see that while there is no systematic change in the participation lift, there does seem to be an increasing trend in the savings associated with other programs for National Grid programs. This could be explained by the fact that participants are taking more meaningful actions as their length of participation in the program increases.

Figure 17. NGRID Participation Lift and Incremental Savings by Cohort – Electric



Note: New cohorts in their first year of implementation are not shown in this graph

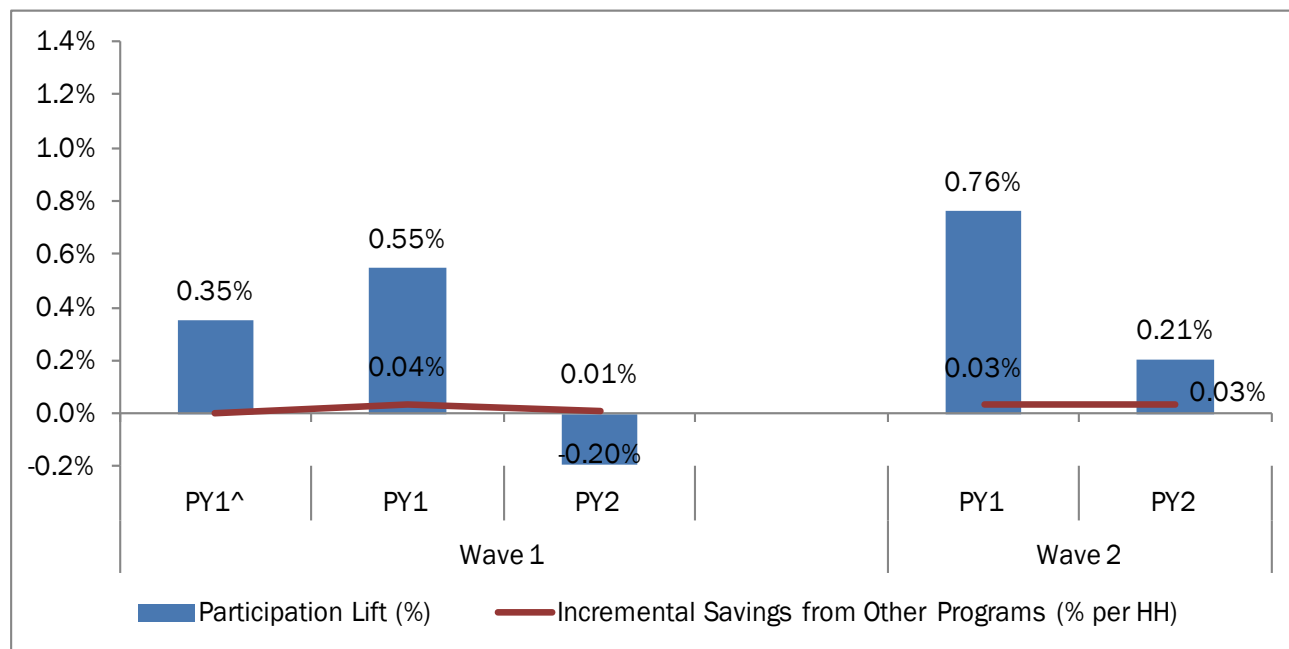
Figure 18. NGRID Participation Lift and Incremental Savings by Cohort – Gas



Note: New cohorts in their first year of implementation are not shown in this graph.

However, for the NSTAR gas cohorts, there appears to be no increase over program years. There is an apparent increase from the first part of PY1 to the second half, but a reduction going into PY2. For Wave 2, the incremental savings remain the same at a very low level.³¹

Figure 19. NSTAR Gas Participation Lift and Incremental Savings by Cohort



Note:

PY1^ is evaluation of the PY1 cycle from August 2010 through April 2011

PY1 is evaluation of the PY1 cycle from May 2011 through December 2011

Overall Channeled Savings

In 2012 the OPOWER HER programs channeled a total of 13,243 additional participants into other residential programs beyond that produced by the control group. The savings associated with these participants totals 3,858 MWh and 27,203 MMBtus, representing 0.2% each of the 2012 statewide lifetime electric and gas savings goal, and 1.3% and 2.4% of the 2012 statewide annual electric and gas savings goal, respectively (see Table 13). Since 2009, the OPOWER HER programs have channeled a total of 24,122 additional participants into other residential programs and generated a total of 5,298 MWh and 28,581 MMBtus.

³¹ NSTAR Electric cohorts are in their first year of implementation and are thus not discussed here.

Table 13. Channeled Savings Achieved by Electric and Gas Programs

	2012 Channeled Savings	2009-2012 Channeled Savings
Electric	3,858	5,298
% of 2012 statewide lifetime goal	0.2%	0.3%
% of 2012 statewide annual goal	1.3%	1.8%
Gas	27,203	28,581
% of 2012 statewide lifetime goal	0.2%	0.2%
% of 2012 statewide annual goal	2.4%	2.6%

Notably, these savings are comparable to the annual savings goals for programs such as the Residential New Construction and Major Renovation (2012 goal of 4,716 MWh) and Multifamily Retrofit (2012 goal of 34,650 MMBtus). However, the Massachusetts Statewide goals are measured in lifetime benefits as opposed to annual benefits.

6. C3 WMS IMPACT FINDINGS

In this chapter we summarize impact analysis and channeling analysis findings of the C3 Western Mass Saves (WMS) program across all treated customers. Customers are defined as follows:

- An **activated household** is any household that activates the online rewards program.
- A **treatment household** is a household designated in the program experimental design to receive an ESR. In the initial wave, treatment households receive an ESR on a quarterly basis. In the expansion wave the ESR is mailed once.
- A **control household** is a household designated in the program experimental design to not receive an ESR.
- An **on-line activator** refers to a household that is not part of the program experimental design (not designated as a treatment or control household in either the initial or expansion wave), but does join the online rewards program.

The types of savings are categorized as follows:

- **Passive Savings:** Effects from report treatment alone (initial wave and expansion wave).
- **Activated Savings:** Effects from online participation alone (any savings generated through online engagement after customers opt-in).
- **Synergistic Effects:** Savings associated with the co-presence of reports and online treatment, unique of both reports and online savings.

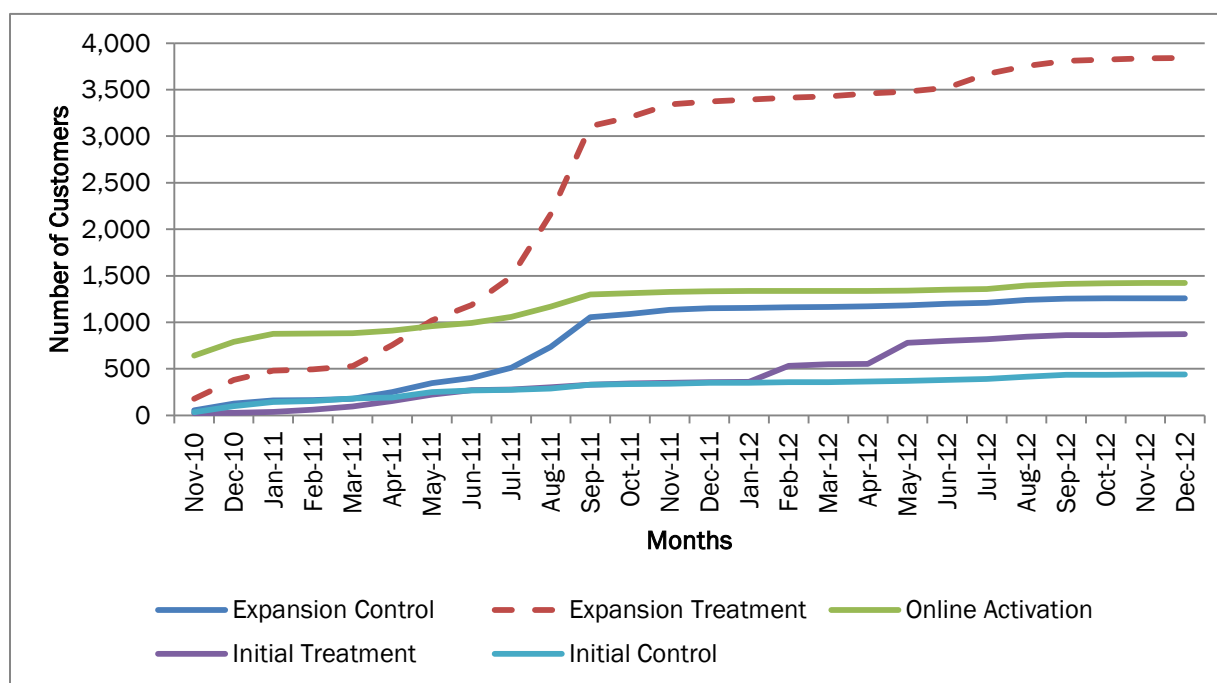
As detailed in the Methodology section, passive and synergistic savings were estimated using a linear fixed effects regression analysis. Activated savings were estimated using a bias-corrected matching analysis.

6.1 WHAT ARE THE PROGRAM IMPACTS?

The section below shows the results from the impact analysis by wave type. More detailed results can be found in Appendix G.

Activation of the Online Web Portal

Figure 20 presents cumulative activation of the web portal. It indicates that the vast majority of activations (about 84%) occurred before 2012.

Figure 20. Cumulative Activation of the Online Web Portal, by Group and Treatment Type

Verification of the Experimental Design

The portion of the C3 WMS program designed as a randomized controlled trial involved two waves of customers: an initial wave with 22,716 treatment customers (at the point of the program evaluation period) and 24,253 control customers. Reports were first mailed to the treatment customers in November 2010, and an expansion wave with 85,642 treatment customers and 31,023 control customers in July 2012 (with reports first mailed to the treatment customers). Results of the statistical verification of the experimental design are presented in Figure 21 and Figure 22. Verification involved comparing average energy use for a number of months before the first mailing of Home Energy Reports (HERs). For the initial wave, the data available for comparison of pre-program energy use by treatment and control customers begins in January 2010, and so the comparison is for only 10 months (January 2010 through October 2010). In none of the months is there a statistically significant difference in means at the 90% confidence level.

For the expansion group, the comparison is for the full year before the start of the program, July 2011 to June 2012. In only one month in this period, November 2011, is the difference in average daily kWh different for treatment and control households statistically significant at the 90% confidence level, and barely at that (t-statistic is 1.69; the t-statistic demarcating the 90% confidence level is 1.65). Keeping in mind that at the 90% confidence level one expects a statistically significant difference due to chance alone in one out of 10 months, this result remains consistent with an RCT design.

Figure 21. Average Daily Energy kWh by Treatment and Control Customers, Initial Group, January 2010 to October 2010

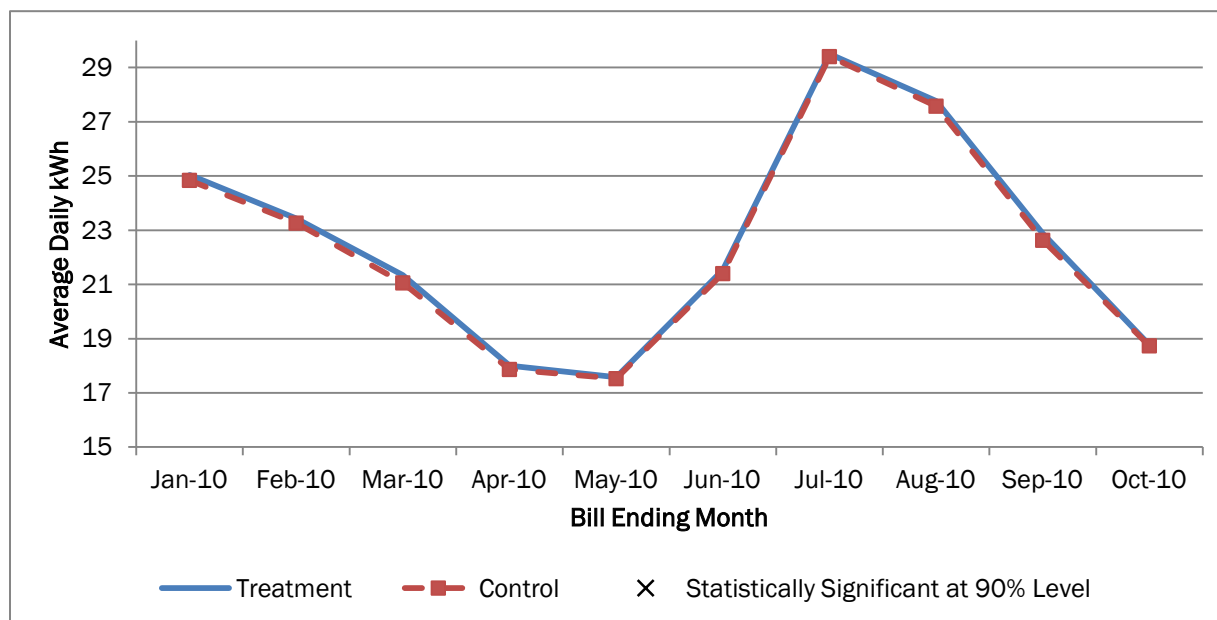
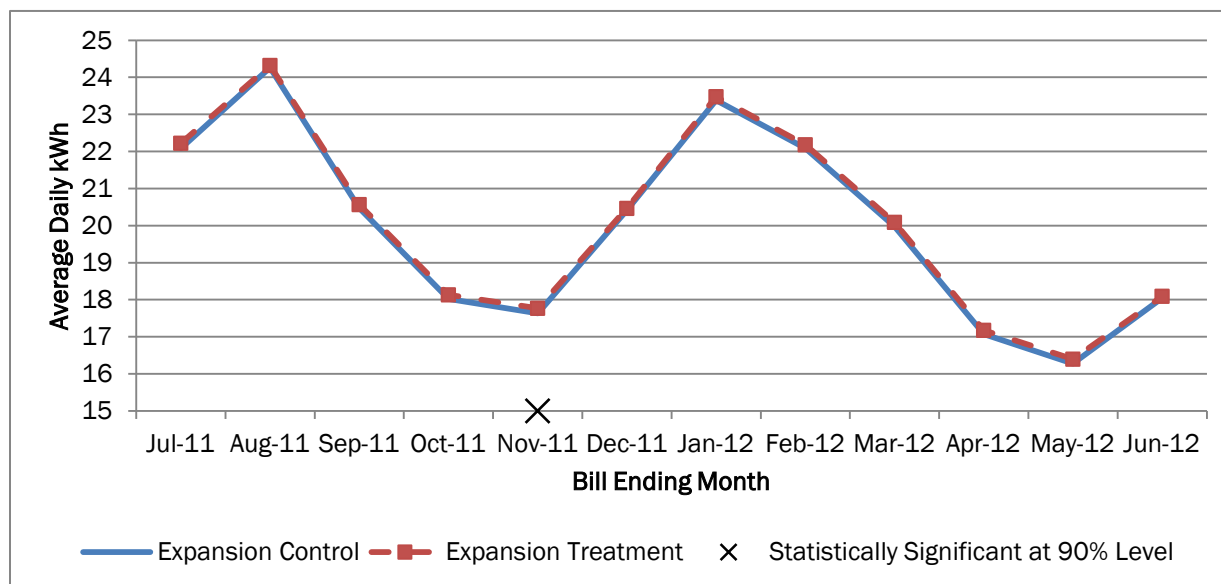


Figure 22. Average Daily Energy kWh by Treatment and Control Customers, Expansion Group, July 2011 to June 2012



Choosing the Method for Analyzing Savings from Activation

As described in Section 3.1, linear fixed effects regression analysis was used to determine the effect of the C3 WMS program *compared to a counterfactual involving only access to the web portal*, but not necessarily activation of it. This estimates the savings associated with the ESR and the synergistic effects of the ESR and online web activation (above the activated savings demonstrated by non-treated activated customers).

To estimate savings derived from access to the web portal *compared to a counterfactual of no program at all*, two statistical methods were considered: the variation in adoption (VIA) approach used by Harding and Hsiaw (2011) in an evaluation of a similar program, and a matching method with bias correction (Imbens and Woolridge 2009, Abadie and Imbens 2011). This estimates the effects of online web portal activation.

The VIA approach was applied to each of the three sets of customers activating the web portal: (1) control customers from the Initial Wave; (2) Expansion Wave customers who activate but do not receive the mailer; and (3) Online Activators. The data used in the analysis of activated Expansion Wave customers included all monthly observations for activated control customers, and all monthly observations for activated treatment customers who activated before July 2012 (and therefore never received the mailer).

Results of this analysis are shown in Figure 23, Figure 24, and Figure 25. Negative values indicate savings. A statistical test of the appropriateness of the model—whether the data conform to the underlying assumptions of the model—is whether there are statistically significant savings due to the program in the months before the program actually takes effect. Such a result indicates that the VIA approach is not appropriate for the analysis. In all three analyses there *is* a statistically significant program effect for at least two of the 12 months before the program starts, and so we reject the VIA approach in favor of the matching method.³²

³² For the initial control customers, 2/12 pre-activation months had statistically significant effects. For the expansion customers and online activation customers this figure was 6/12 and 11/12, respectively.

Figure 23. Estimated Percent Monthly Program Effect, VIA Method, Initial Wave (negative values indicate positive savings)

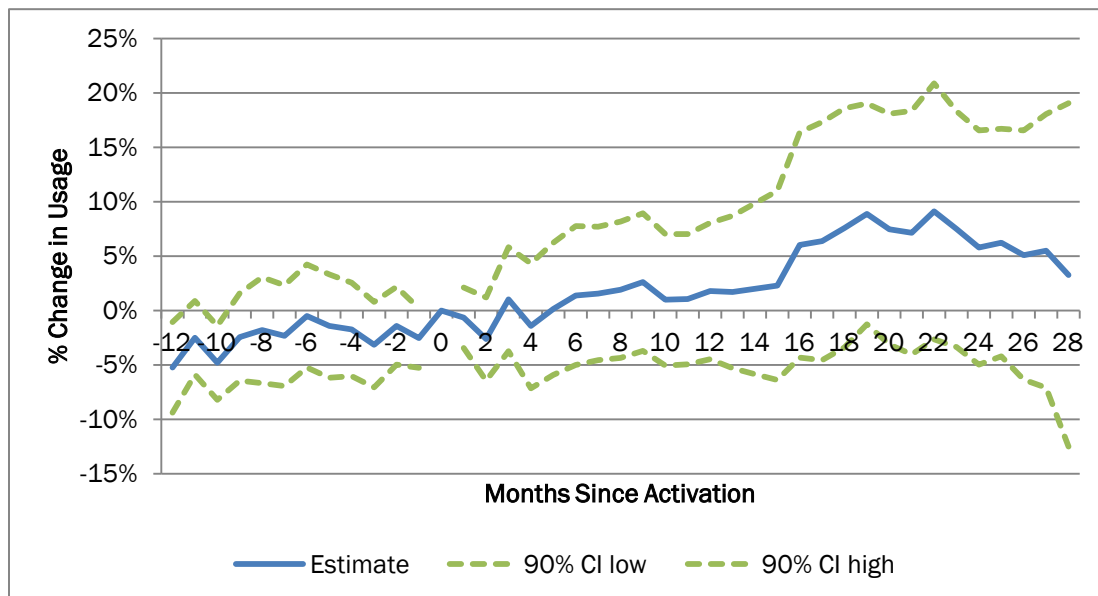


Figure 24. Estimated Percent Monthly Program Effect, VIA Method, Expansion Wave (negative values indicate positive savings)

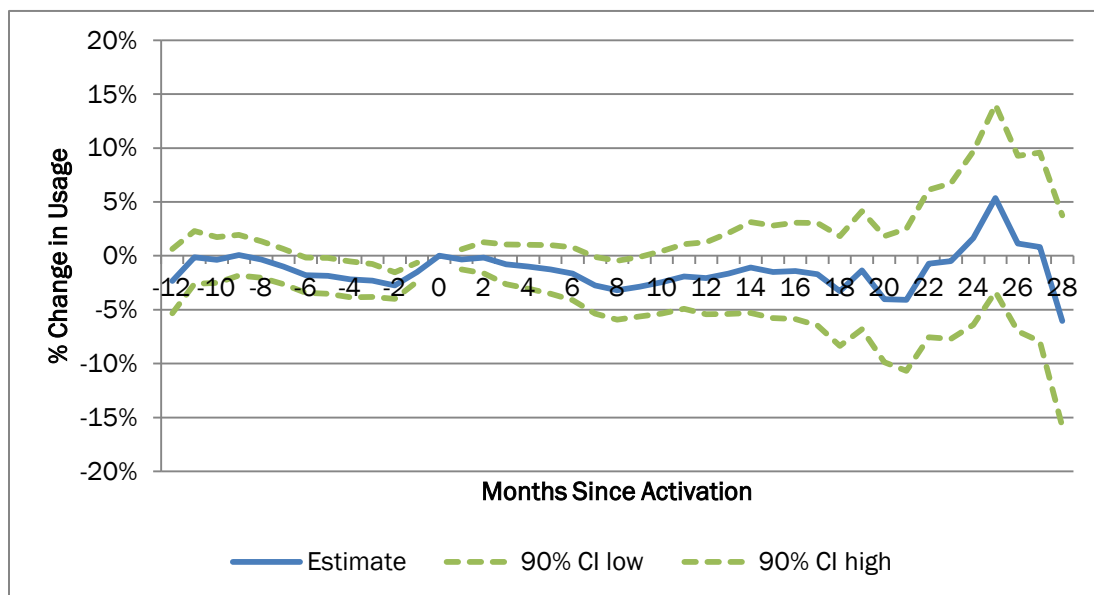
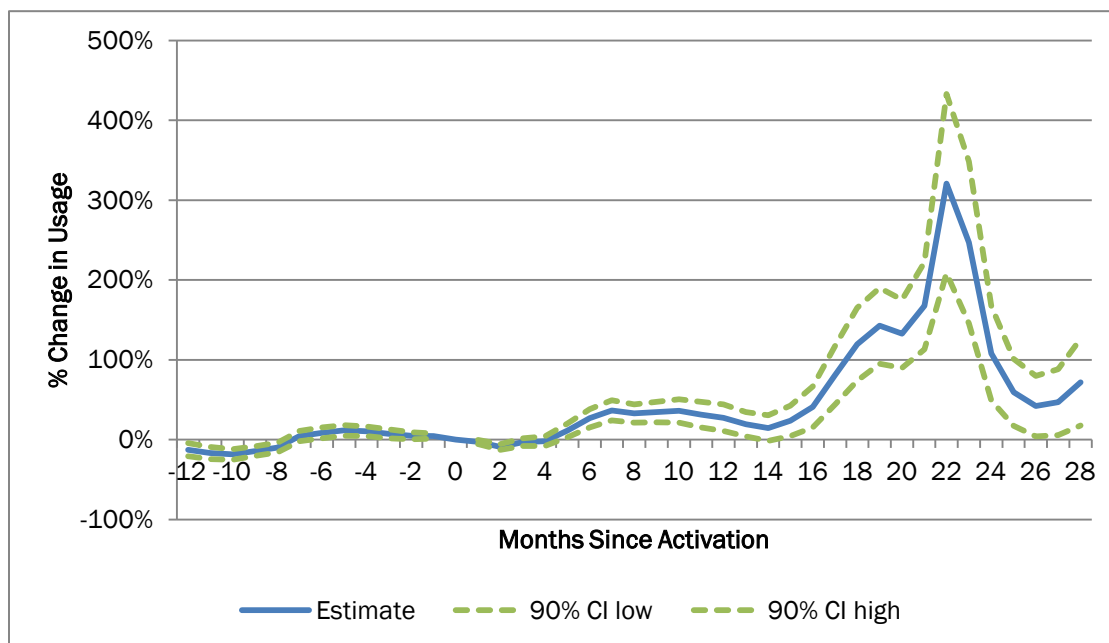
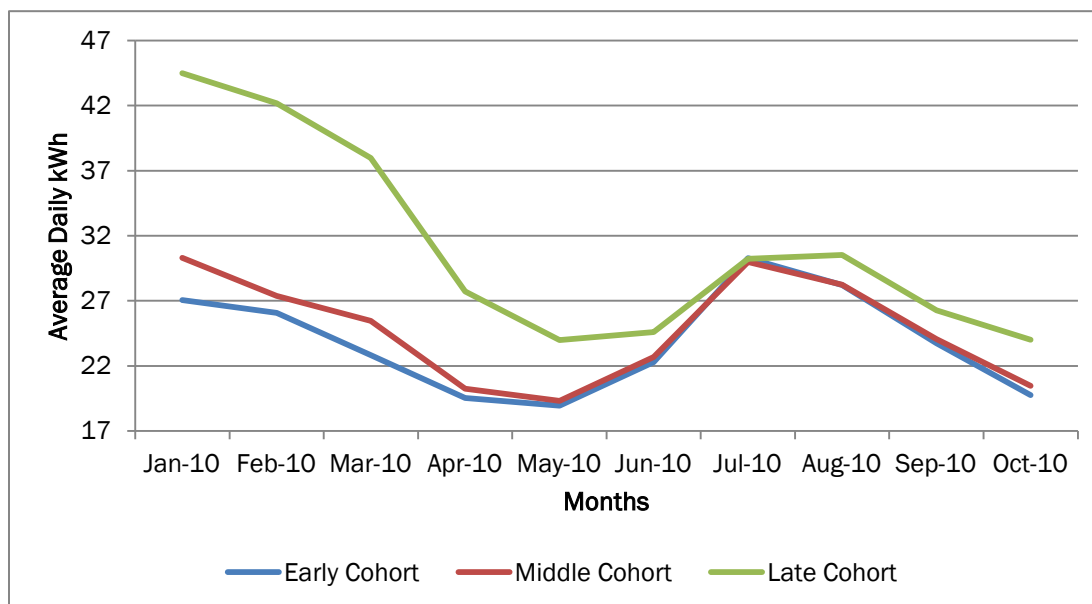


Figure 25. Estimated Percent Monthly Program Effect, VIA Method, Online Activators Wave (negative values indicate positive savings)



The extraordinary result for online activators—*negative* savings peaking at over 300% 22 months after activation—deserves comment. Figure 26 breaks these customers into three equal-sized groups based on the date of activation—an early cohort, a middle cohort, and late cohort—and compares their average monthly energy use in the 10 months before the start of the program, January to October 2010. The data indicate that winter energy consumption by the late cohort is far greater than that of the early and middle cohorts. This observation, along with the fact that very few late cohort customers are in the program for more than 17 months, explains this result.

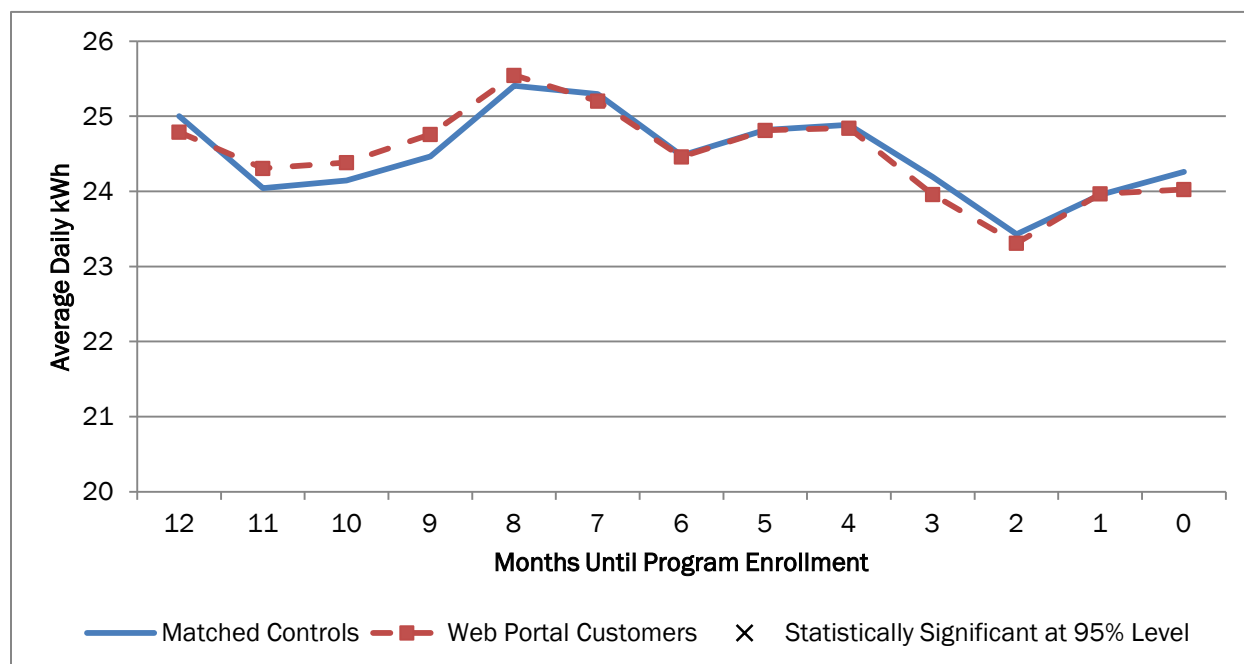
Figure 26. Comparison of Energy Use across Activation Cohorts in the Pre-Program Period, Online Activators



Details of the Matching Method

The matching method begins with the development of matches for each customer that has activated through the web portal. This includes activated ESR-treated customers as well as online activated customers (who received no ESR treatment). In this analysis, matching was based on comparisons of the energy use by candidate match customers with energy use by an activating customer during the 12 months before the program customer activated the web portal. The pool of potential matches was the set of control households in the Initial and Expansion Waves that did not activate online through the web portal. The basis of the comparison is the difference in monthly energy use between a participant and a potential match, DPM (Difference between Participant and potential Match). The quality of a match is denoted by the Euclidean distance to the participant over the 12 values of monthly DPM; that is, denoting by SSD the sum of squared DPM over the matching period, it is denoted by $SSD^{1/2}$. The best match is the one with the closest distance to the energy use of the activating household. We used composite matches, where matches are made for each season of the 12-month period, so a “best match” may be a composite of four different customers.

Figure 27 presents the average energy use of activating households and their matches for the 12 months before activation. Average difference between activating households and their matches over the full 12 months is very low at 5.96 kWh, which, given average energy use for the 12 months of 8,801 kWh, is 0.067% of energy use. Moreover, the bias correction of the method (see discussion of the method in the section on CLC’s SHEMP program evaluation approach) corrects for remaining disparities in estimated savings that are correlated with disparities in the matching period.

Figure 27. Average Daily Energy kWh by Treatment and Control Customers, Activated Households

Estimates of 2012 Program Savings

Table 14 presents estimates of program savings in 2012. Confidence intervals on all results are presented in Table 15.

Total savings for 2012 are 2,788 MWh, with 525 MWh jointly produced with other EE programs (see the discussion of channeling analysis results below). Average savings for activating customers ranged from 0.9% for customers who were retained as part of the report/mailer control group by C3 and activated in the Initial Wave, to 1.9% for online activators. The bulk of the total program savings were derived from the ESRs received by customers in the Initial Wave.

Table 14. Estimates of 2012 Program Savings

Group	Program Savings					Savings Jointly Produced with EE Programs (MWh)		
	MWH Savings: Activated Savings	Percent Savings per HH: Activated Savings	MWH Savings: Passive Savings + Synergistic Effects of Passive & Activated Savings	Percent Savings per HH: Passive Savings + Synergistic Effects of Passive & Activated Savings	Total Savings (MWh)	Jointly Produced to Baseline of Web Access Only	Additional Jointly Produced to Baseline of No Program	Total Savings Net of Jointly Produced Savings (MWh)
Initial Wave	49	0.91%	1,958	1.07%	2,007	80		
Expansion Wave	423	1.03%	104	0.04%	527	56		
Online Activations (no reports)	254	1.93%	--	--	254	--		
Program Total	726		2,062		2,788	136	525	2,127

Notes:

Passive Savings: Effects from report treatment alone (Initial Wave and Expansion Wave).**Activated Savings:** Effects from online participation (any savings generated through online engagement after customers opt-in).**Synergistic Effects:** Savings associated with the co-presence of reports and online treatment, unique of both reports and online savings.

Table 15. Confidence Intervals of 2012 Program Savings

Group	MWH Savings: Activated Savings	90% Lower Confidence Bound (MWh)	90% Upper Confidence Bound (MWh)
Initial Wave			
Activated Savings	49	2	96
Passive Savings + Synergistic Savings	1,958	1,230	2,686
Expansion Wave			
Activated Savings	423	309	537
Passive Savings + Synergistic Savings	104	-238	446
Online Activations (no reports)	254	164	345

Evidence for the Increasing Savings Obtained by the Initial Treatment Group

Figure 28 and Figure 29 present the changes over time in the average daily savings per customer and percent savings for the initial treatment group. The savings are based on the LFER analysis and thus reflect both passive savings plus the synergistic effects of the ESRs and activation of the web portal. Savings are clearly rising over time, as reflected in the fact that for every season year-over-year savings have increased, culminating in savings of 1.62% in Winter 2013, the most recent season for which data are available.

Figure 28. Estimate of Average Daily Value and 90% Confidence Intervals for Passive Plus Synergistic Savings, Initial Wave

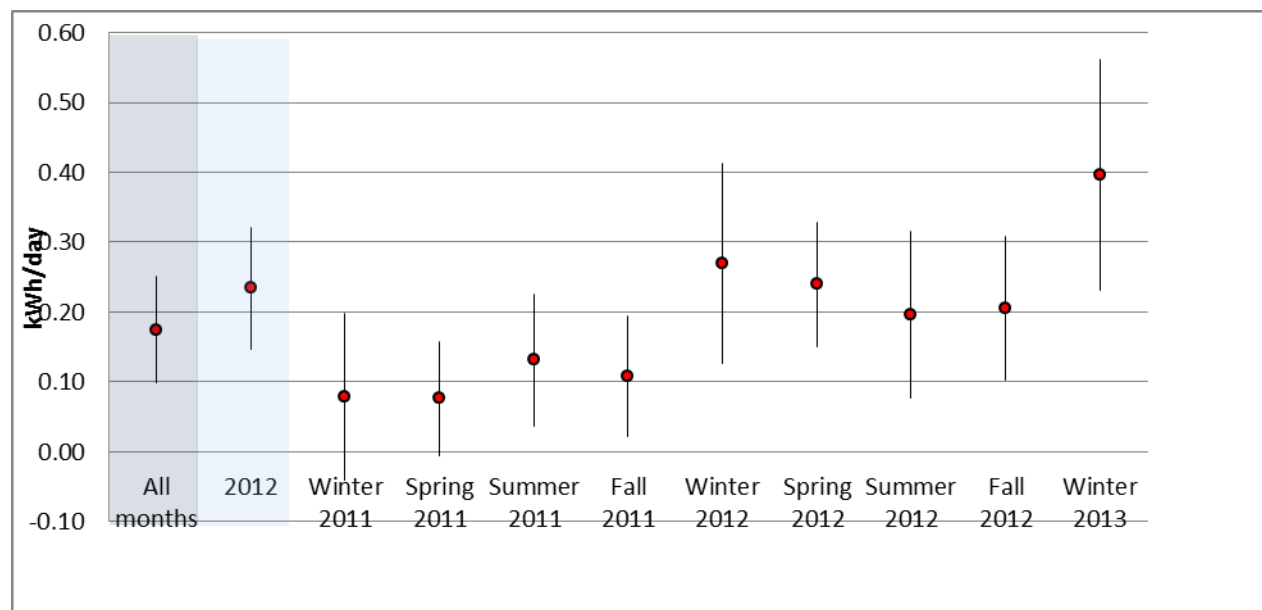
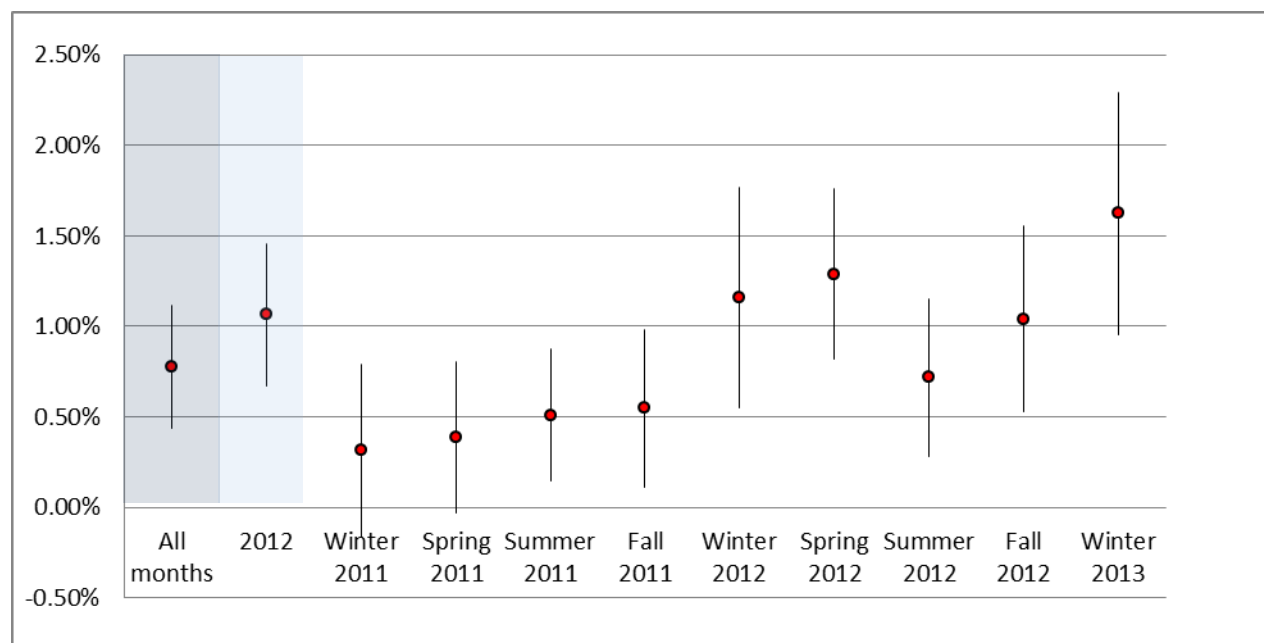


Figure 29. Estimate of Percent Savings and 90% Confidence Intervals for Passive Plus Synergistic Savings, Initial Wave



6.2 DOES THIS PROGRAM LEAD TO PARTICIPATION AND SAVINGS IN OTHER PROGRAMS?

The channeling analysis method described in Section 3.2.1 was used to estimate participation lift and jointly produced savings between the EMS program and four EE programs: the Appliance Retirement program, the Mass Save Energy Audit program, the Multi-Family program, and the RHVAC program. Two types of channeling analyses were conducted. The first applies to program households receiving ESRs *after* they receive the first energy report, and is intended to estimate participation lift after receipt of the ESRs. In this analysis the reference population is drawn from the control population. For the Initial Wave it is the entire control population, and for the Expansion Wave it is the portion of the control population that has not activated as of the delivery of the mailer in July 2012. This latter restriction is necessary because all expansion treatment households that activate before July 2012 are *not* sent a mailer.

The second channeling analysis applies to activated households that do not receive an ESR. This includes control households from the Initial Wave, all expansion customers except those that activate after receiving the ESR, and all online activators. It measures the jointly produced savings that arise because web portal activation is a source of lift in participation and savings in the EE program. For these customers the reference population is the set of annual (non-composite) matches—that is, the set of best matches for the activators based on the full 12 months of energy use prior to activation. Composite matches are inappropriate for the task because for such matches it is possible to observe multiple enrollments in any EE program.

Results of the channeling analysis are presented in Table 16 below. Web portal activation appears to be an especially potent source of participation lift in the Mass Saves program.

Table 16. 2012 Estimates of Participation Lift and Jointly Produced Savings

Group	Program							
	Appliance Retirement		Mass Saves		Multi-Family		RHVAC	
	Uplift of Customers / Rate of Uplift	Jointly Produced Savings (MWh)	Uplift of Customers / Rate of Uplift	Jointly Produced Savings (MWh)	Uplift of Customers / Rate of Uplift	Jointly Produced Savings (MWh)	uplift of customers / rate of uplift	Jointly-produced savings (MWh)
Initial Wave: ESR recipients	13 / 0.058%	8	26 / 0.111%	41	11 / 0.048%	27	19 / 0.083%	4
Expansion Wave: ESR recipients	-4 / -0.004%	3	47 / 0.052%	43	2 / 0.003%	1	17 / 0.019%	15
Activated Households that do not receive an ESR household	30 / 0.431%	24	431 / 6.191%	388	14 / 0.201%	7	107 / 1.537%	106

7. CLC SHEMP PROCESS AND IMPACT FINDINGS

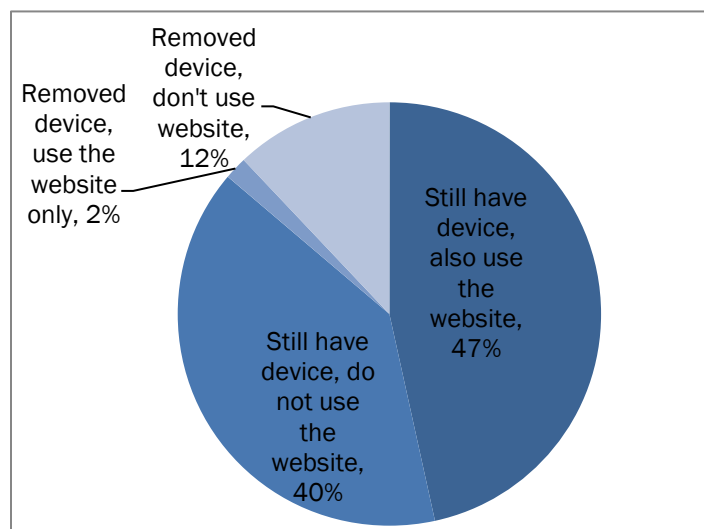
7.1 PROCESS FINDINGS

This chapter presents our process evaluation findings based on our survey of SHEMP Energize participants. This section is organized by the key areas of our findings: first, participants' level of engagement with the in-home display (IHD) and supporting website information and second, the in-home display and website's educational effects in the home. We add context to our survey findings with findings from our literature review to explore insights from other energy feedback programs where relevant.

7.1.1 Engagement with Device and Website

The first key area from our survey findings is tracking customers' ongoing engagement with the IHD information, both through the device itself and through the connected pilot website. Across all participants who have received the device, nearly half (47%) say that they still use both the device and the website, while slightly fewer (40%) say that they use the device only. Only one participant who removed the device said that they only use the website. Most participants who removed the device (12% of all participants) said that they use neither the device nor the website.³³ Figure 30 shows participant engagement with the information available through the pilot.

Figure 30. Participant Engagement with SHEMP Pilot Information Types (n=58)



Base: Participants who received an in-home display device.
Note that participants who said they “never” use the website are classified as participants who do not use the website.

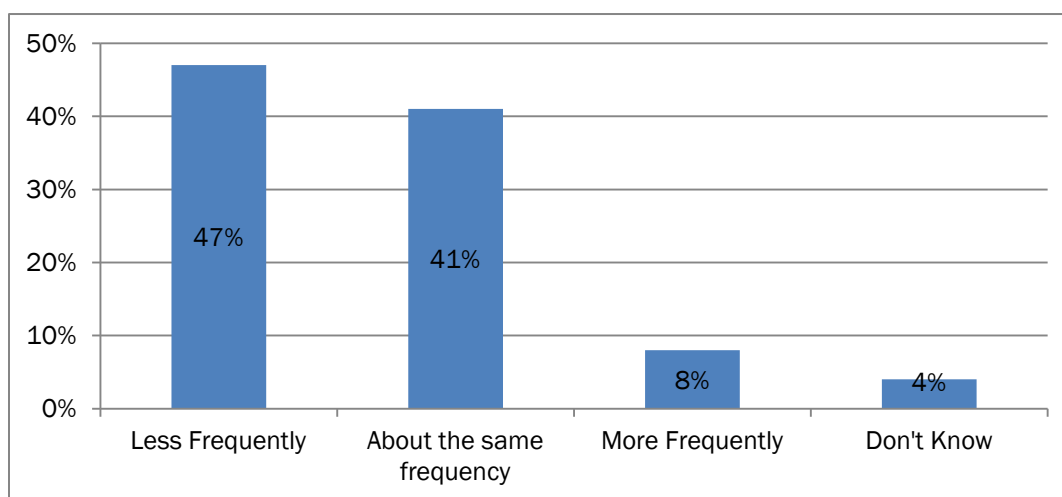
³³ Note that some participants said that they have used the website but that they “never” use it now. Customers who said they “never” use the website are classified as non-website users (e.g., if they use the device and “never” use the website, they are classified as “Still have device, do not use the website”).

7.1.2 Engagement with the In-Home Display Device

Engagement with in the in-home display tends to decrease over time. We asked customers how often they use the in-home display now, compared to when they first received it. As seen in Figure 31 below, nearly half of the customers report using the in-home display less frequently. This indicates that while customers are interested in the technology in the short-term, they lose interest over time.

Our literature review of feedback programs (see Appendix J) suggests that energy information display programs frequently face decreased engagement over time as the information becomes less novel. To address this decrease, we found that programs that are proactive and regularly reach out to participants throughout the participation period are better able to maintain customer engagement.

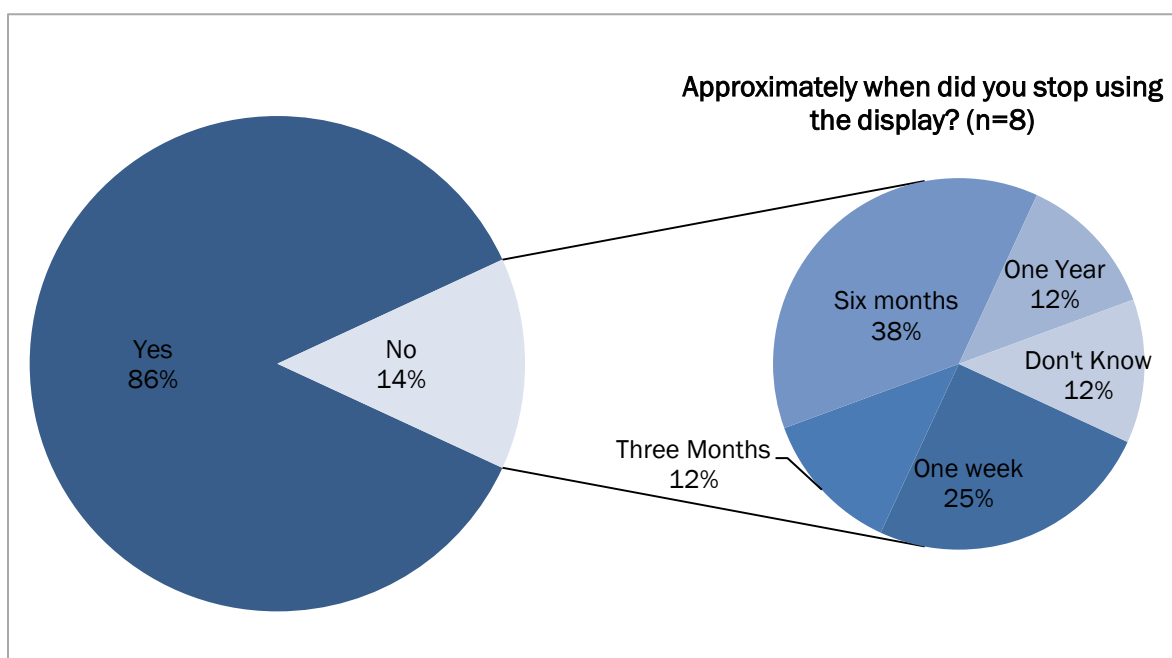
Figure 31. Engagement with In-Home Display After Installation (n=49)



Base: Respondents in Post Group with EID currently installed

While most customers currently have the in-home display still installed, about one in seven removed the device within one year. As shown in Figure 32 below, among those who removed the device, the majority (75%) stopped using the device within six months, and a quarter stopped within a week. In the context of Figure 31 above, customers may be removing the device because they no longer use it or have lost interest in the device. Future research should investigate reasons for uninstalling the device.

Figure 32. Percent of Customers with In-Home Display Installed (n=58)



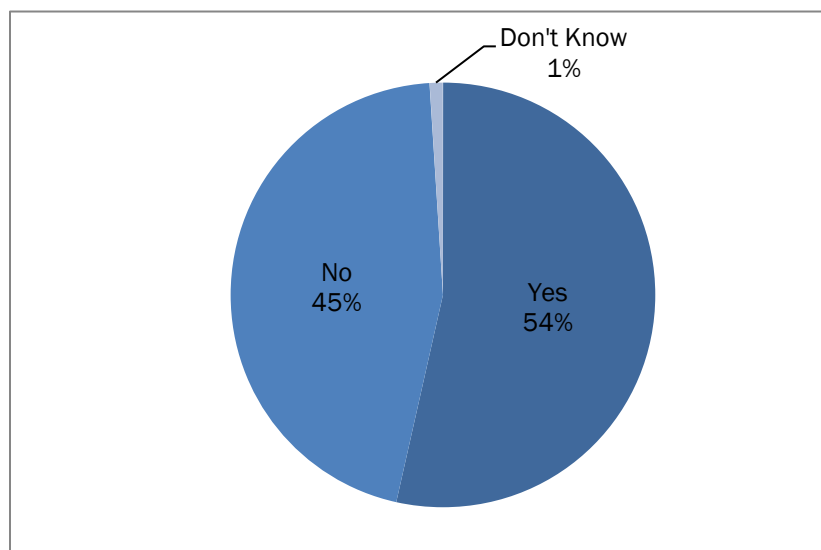
Base: Post Group

7.1.3 Engagement with the Website

Many customers do not use the Smart Home Energy Monitoring website, and those that do access the site use it once a month to once every few months. As seen in Figure 33, only about half (54%) of customers have accessed the website before. Furthermore, as shown in Figure 34, only about 12% of participants who use the website indicated that they use it once a week or more. Notably, most participants said they use the website either once a month (24%) or once every few months (39%), roughly as frequently as customers receive their energy bills. Some customers (10%) said that although they have accessed the site, they never use it now.

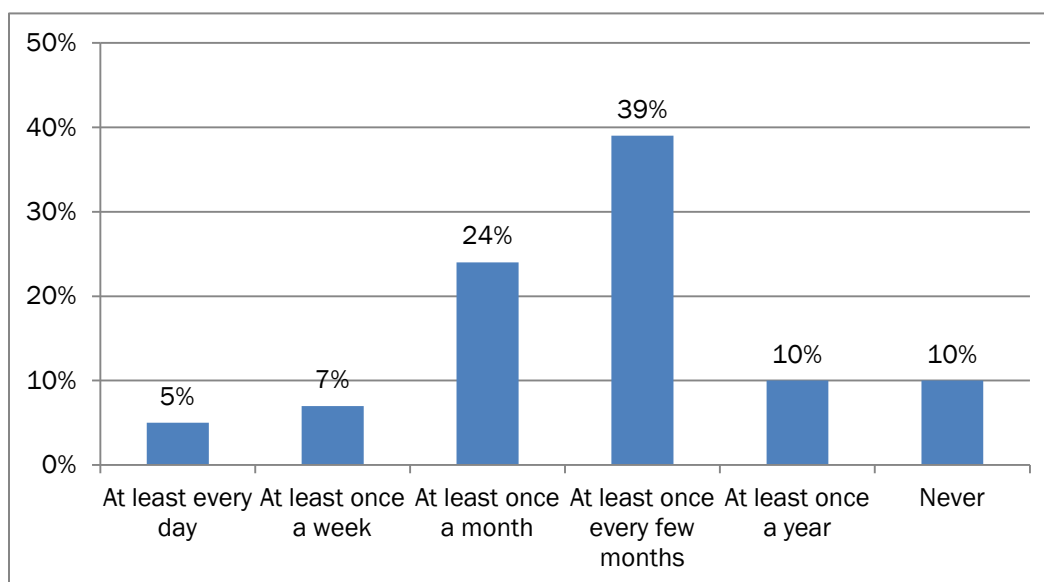
Our literature review of past feedback programs found that customers who engage with websites are more likely to produce higher energy savings. While the website is not attracting all participants, its presence and the information offered may help increase the per-participant savings from customers who use it. The literature review also found that additional social and reward elements with the website may help increase customer engagement and energy savings.

Figure 33. Percent of Customers Using the Smart Home Energy Monitoring Pilot Website to Monitor Energy Use (n=77)



Base: Post Group.

Figure 34. Frequency of Access to the Pilot Website (n=41)



Base: Respondents in Post Group who have used the pilot website.

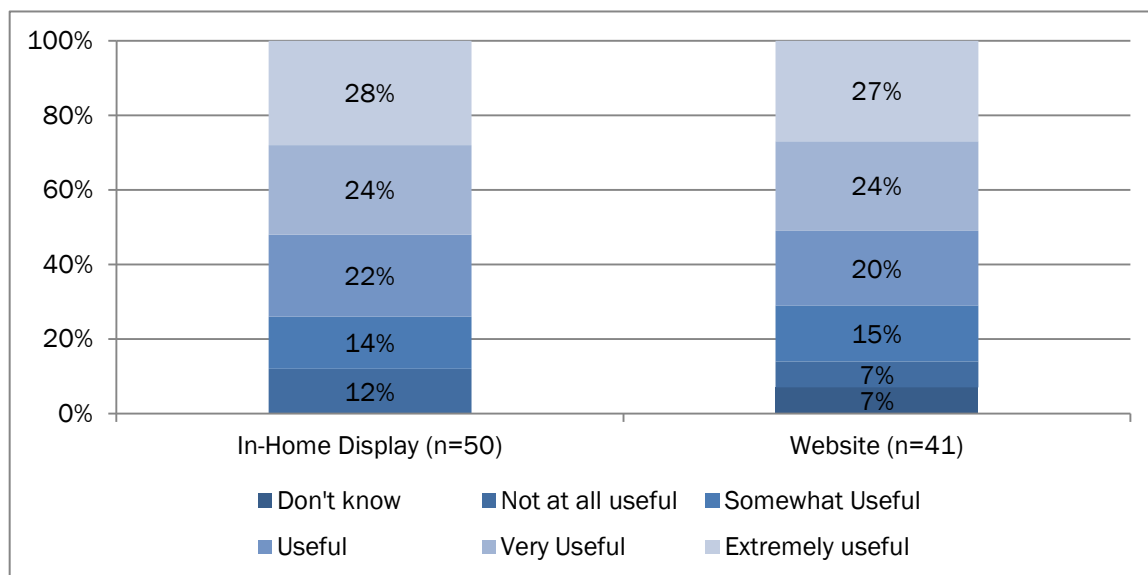
7.1.4 Information Usefulness and Education

The second key area from our survey explored how customers reacted to the information they received from the device and website, first by rating the usefulness of the information and then by describing the educational effects that the information had on their household.

7.1.5 Usefulness of Information

Most customers rate the website and IHD information equally in terms of their usefulness. While many participants felt it did not provide enough information to make changes, most customers (88%) found the in-home displays to be at least “somewhat useful.” Furthermore, the vast majority of customers (86%) who accessed the pilot website found it to be at least “somewhat useful.”

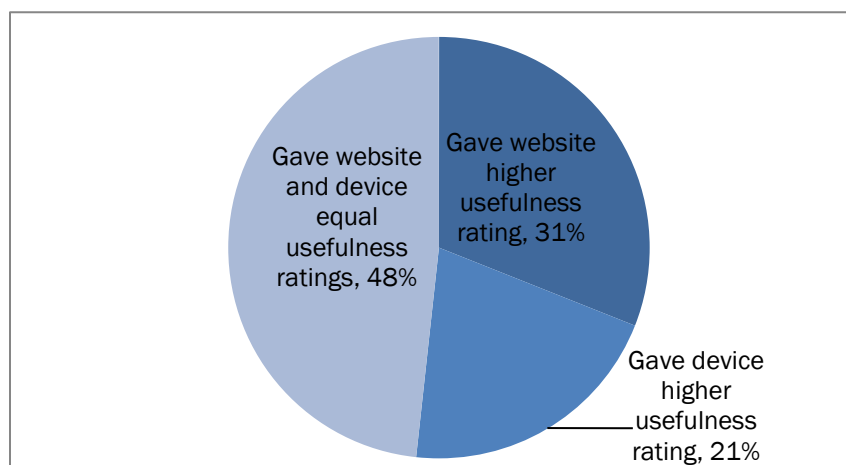
Figure 35. In-Home Display’s Usefulness (n=50)



Base: (Left) Respondents in Post Group with EID currently installed; (Right) Respondents in Post Group who have used the pilot website

Of those who have used both the device and the website, there is not a clear preference. As shown in Figure 36, about half of participants who use both (48%) rated them equally in terms of usefulness, while some (31%) rated the website as more useful and others (21%) rated the device as more useful.

Figure 36. Participant Ratings: Website and Device Usefulness (n=29)*

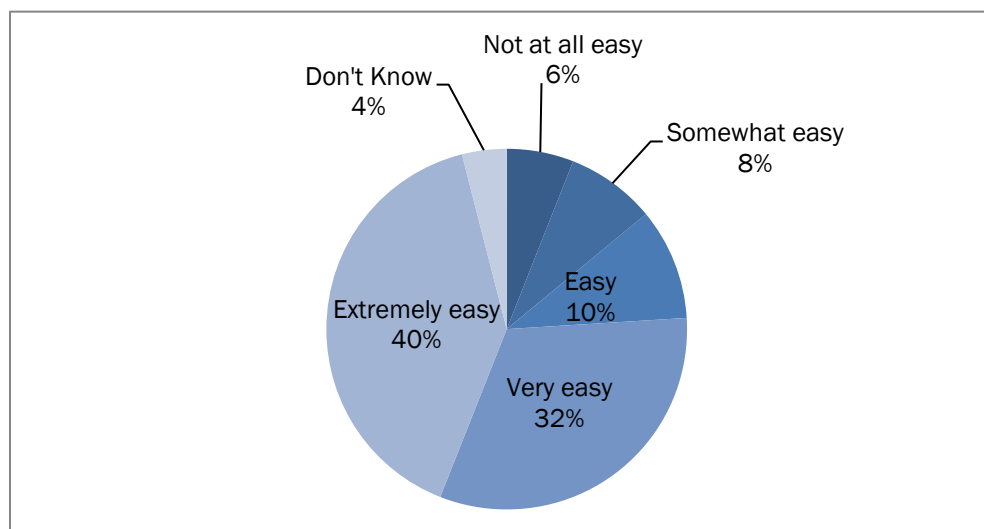


*Base: Participants who used the website and still have the device installed. Percents based on which element (website or device) received a higher rating on a one-to-five scale.

7.1.6 Educational Effects

Most customers feel they understand the information provided by the in-home display. As can be seen in Figure 37 below, the majority of participants (72%) found the information on the in-home display was “extremely easy” or “easy” to understand.

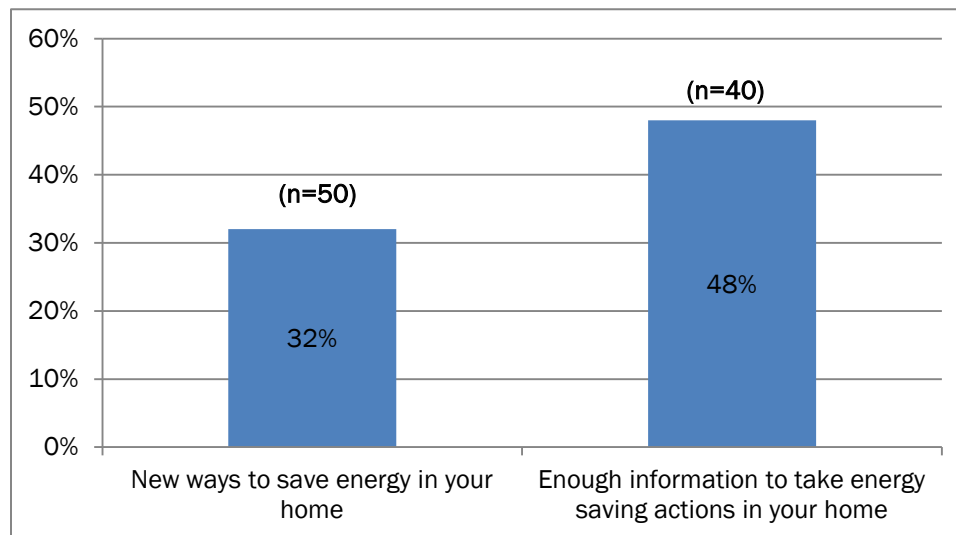
Figure 37. Participant Ratings: Device as Easy to Understand (n=50)



Base: Respondents in Post Group with EID currently installed

Although the information the device provided was rated as easy to understand, the majority of customers reported that the in-home display did not provide *enough* information to make changes at home. As shown in Figure 38 below, less than one-third of respondents reported that the in-home display provided them with new ways to save energy. Furthermore, more than half reported that they did not have enough information on how to make additional changes.

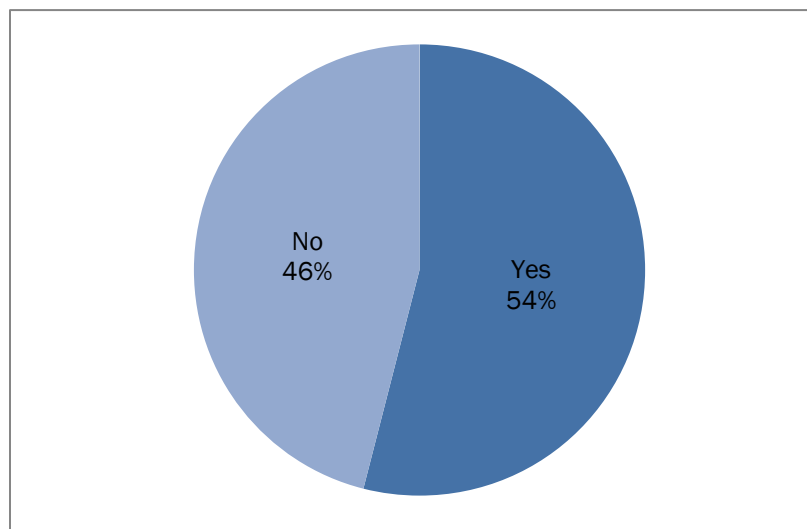
Figure 38. Participant Ratings: Did the In-Home Display Provide You With...?



Base: Respondents in Post Group with Energy Information Display (EID) currently installed

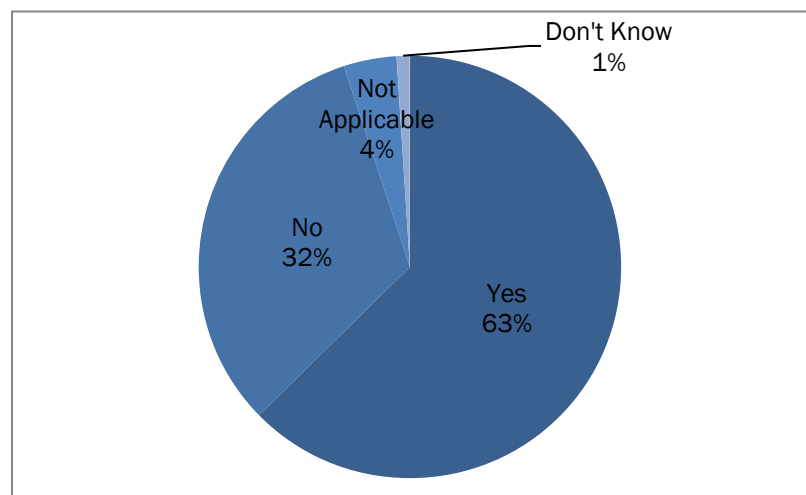
Slightly more participants (54%) who used the website said that the website gave them enough information to take action to save.

Figure 39. Participant Ratings: Website Provides Customers with Enough Information to Take Energy Saving Actions at Home (n=41)



After participating in the pilot, customers tend to share ideas about energy efficiency. As can be seen in Figure 40 below, since participating in the Smart Home Energy Monitoring Pilot, nearly two-thirds (63%) of participants shared their knowledge on how to save energy with other people in their household.

Figure 40. Percent of Participants Discussing or Sharing Ideas on How to Save Energy with Other People in Household since Pilot Participation (n=77)

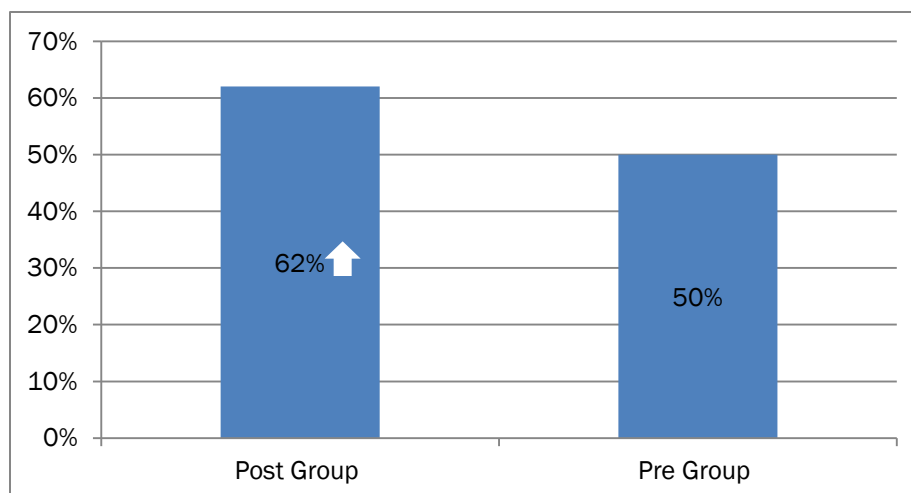


Base: Post Group

Customers who are learning new information are significantly more likely to share the information; however, customers are sharing information even if the information is not new to them but at lower rates. More than half (58%) of participants who did not get enough information to act from the pilot nonetheless talked with their families about ways to save. For those who did learn something, it was significantly higher (85%).

Participants show significantly higher awareness of CLC programs after participating in the SHEMP. As shown in Figure 41 below, about half (50%) of participants in the pre-group and nearly two-thirds (62%) of participants in the post-group are aware of alternative programs to the Smart Energy Monitoring offered by CLC, indicating a significant increase from pre-pilot participation.

Figure 41. Percent of Participants Aware of Alternative Energy Saving Programs (n=52)



Base: Pre- and Post-Group who recalled receiving device and took both surveys.
Arrow indicates a statistically significant difference at 90% confidence.

7.2 ACTIONS TAKEN

In this section, we present our results of the CLC SHEMP Energize customer responses in the pre- and post-period to questions on actions taken the past month. The differences demonstrated between the pre- and post-periods provide an indication of the actions taken as a result of the SHEMP Energize treatment. To add context to these findings, we also provide comparisons of the findings drawn from other previously fielded Program Administrator (PA) survey efforts, specifically National Grid and WMECo. It is important to note that the three PAs each implemented different behavioral programs: National Grid implemented OPOWER, WMECo implemented C3, and CLC implemented the Tendril IHD device. It is also worth noting that the WMECo and CLC surveys were fielded using a pre-post design, whereas the National Grid initiative compared customers against a control group. Here, we summarize the key findings presented in the tables in this section.

Notably, CLC participants showed a number of key differences in their survey responses as compared to other PAs:

- Significantly fewer CLC respondents reported taking action in the post-treatment period than in the pre-treatment period for low-cost measures and for energy efficiency appliances.
 - However, the percentage of respondents who installed these measures during the pre-treatment period was already high (51.9% low-cost measures, 28.6% appliances). This indicates that many participants put new energy efficient measures in place shortly before they installed the IHD and thus were unlikely to replace them with new versions during the one-year participation period.
 - These findings suggest that some pilot participants may be using the IHD information to monitor usage after efficient measures are installed and/or they may be actively seeking out ways to save energy, this pilot being one of the actions taken among many.
- Furthermore, respondents reported just one significant change in conservation behaviors after receiving treatment when compared to the pre-period. We found a significant reported increase in hanging laundry to dry during the pilot period.

Overall, these behavioral findings suggest that SHEMP Energize respondents were actively taking action prior to participating in SHEMP, and did not dramatically increase this behavior as a result of the pilot (as can be detected in the survey findings). However, the savings do suggest some action on the part of participants indicated in the observed increase in conservation action, but this is detected in only one action.

Table 17. Measure and Behavior Composites

(Percent of eligible customers installing at least one item in category)^{a,b}

Measure group	OPOWER						Efficiency 2.0		Tendril IHD	
	National Grid (electric)		National Grid (gas)		National Grid (all fuels)		WMECo		CLC	
	% Part. ^c	% Cntl. ^c	% Part.	% Cntl.	% Part.	% Cntl.	% Post-treatment	% Pre-treatment	% Post-treatment	% Pre-treatment
High-efficiency measures^a										
Heating / cooling	11.9%	8.6%	8.6%	8.1%	10.2%	8.4%	10.3%	8.0%	14.3%	7.8%
Appliances	28.2	22.8	21.5	16.8	24.8^	19.8	17.0	14.1	16.9	28.6^
Consumer electronics	22.8**	14.0	17.9	13.2	20.4**	13.6	14.3	7.1	16.9	20.8
Light fixtures	9.3	9.2	10.8^	6.5	10.0	7.8	7.0	6.0	6.5	3.9
Building envelope	18.0**	10.7	13.9**	7.3	16.0**	9.0	34.0	29.0	13.0	18.2
Low-cost measures	49.6**	40.6	41.0	37.6	45.3**	39.1	11.5	10.3	27.3	51.9**
Behaviors^b										
Hot water usage	41.2	35.1	39.8	37.6	40.5	36.3	47.0	42.0	33.8	35.1
Lighting	34.0	37.5	39.8	34.8	36.9	36.1	59.0**	31.0	29.9	33.8
Consumer electronics	41.2	37.8	45.4	40.4	43.3	39.1	59.0**	38.0	42.9	36.4
HVAC maintenance	22.1	26.3	24.4	29.6	23.2	27.9^	33.0	34.0	19.5	18.2
Space heating and cooling	27.2	28.7	34.7	31.6	30.9	30.1	46.0**	30.0	19.5	23.4
Refrigerator maintenance	20.0	19.1	21.3	23.6	20.7	21.4	39.0	32.2	18.2	27.3
Home Energy Audit										
Home Energy Audit	3.7	4.9	8.2	7.3	5.9	6.1	9.2	4.6	14.3	18.2

^a Measure composite metric: Purchased or installed at least one energy efficient item in measure group in past year (as % of eligible base). This metric does not imply positive net savings from these measures, as some could be additional units. High-efficiency measure groups are described in Table 19 and Table 20.

^b Behaviors metric: Started or increased at least one of items in behavior group in past year (as % of eligible base). Behavior measure groups comprise the following measures:

- **Hot water usage:** Wash laundry in cold water, fully load washing machine or dishwasher, take short showers, reduce water heater temperature.
- **Lighting:** Turn off lights in unoccupied rooms, turn off outside lights by day, use task lighting or lighting timer.
- **Consumer Electronics:** Turn off computers, TVs, video game consoles, and power strips when not in use; put computers to sleep.
- **Space heating/cooling:** Lower window shades, use insulation or quilts, use portable window fan, set thermostat to recommended set points.
- **HVAC maintenance:** Maintain heating and cooling system, change furnace filter or boiler water, clean or replace air filters, clean areas around vents.
- **Refrigerator maintenance:** Make sure refrigerator seals are tight, clean refrigerator coils, check refrigerator temperature.

Note that hanging laundry to dry is not included in behavioral measure groups. See Table 22 for details.

^c Part. are behavioral program participants who receive HER and Cntl. are control group members

** Significantly higher than other treatment group at 95% confidence level.

^ Significantly higher than other treatment group at 90% confidence level.

Table 18. Measure and Behavior Composite, Actions Taken as Percentage of Eligible Actions

Average count and percentage of eligible measures or behaviors taken

Measure group	National Grid (electric)		National Grid (gas)		National Grid (all fuels)		WMECo		CLC	
	Part.	Cntl.	Part.	Cntl.	Part.	Cntl.	Post	Pre	Post	Pre
Measures										
Average n. of eligible measures	26.2	25.9	26.1	26.1	26.2	26.0	25.0	25.1	27.1	27.2
Average n. of measures taken	2.1	1.9	1.9**	1.4	2.0**	1.6	1.5	1.1	1.3	2.0**
Average % of eligible measures taken	8.1%	7.2%	7.3%**	5.3%	7.7%**	6.3%	5.6%	4.3%	4.7%	7.2%
Behaviors										
Average n. of eligible behaviors	24.2	24.1	24.1	24.1	24.2	24.1	23.3**	22.0	24.1	24.2
Average n. of behaviors started or increased	3.3	3.4	3.8	3.6	3.5	3.5	5.2**	3.7	3.1	2.7
Average % of eligible behavior started or increased	13.6%	14.1%	15.4%	15.0%	14.5%	14.6%	22.3%	16.6%	12.9%	11.3%

Note: Eligible actions defined as the number of actions for which the person was in the “eligible base” for measures.

** Significantly higher than other treatment group at 95% confidence level.

^ Significantly higher than other treatment group at 90% confidence level.

Table 19. Changes in Measure Installations, High-Cost MeasuresPercentage of eligible customers who purchased or installed high-efficiency measures in past year^a

Measure	Eligible base	National Grid (electric)		National Grid (gas)		National Grid (all fuels)		WMECo		CLC	
		Part.	Cntl.	Part.	Cntl.	Part.	Cntl.	Post	Pre	Post	Pre
Heating / Cooling											
Central AC (ES) ^a	Homeowners & have unit	3.3%	2.6%	6.7%	4.0%	5.0%	3.4%	3.7%	3.4%	6.9%	0.0%
Room or wall AC (ES)	Homeowners & have unit	12.3	9.8	8.4	7.0	10.3	8.5	9.3	9.3	12.9	10.3
Boiler (ES)	Homeowners & have unit	2.3	3.8	1.5	2.9	1.9	3.4	3.2	0	4.5	7.3
Furnace (ES)	Homeowners & have unit	1.9	3.0	2.8	2.9	2.3	2.9	3.8	2.5	3.5	1.7
On-demand or tankless water heater	Homeowners	2.9^	0.8	1.2	1.2	2.0	1.0	2.3	0	5.2**	0.0
Appliances											
Clothes washing machine (ES or front-load)	Have unit	14.9^	10.0	12.9	10.8	13.9^	10.4	10.2	6.1	5.2	19.5**
Dishwasher (ES)	Homeowners & have unit	9.5	10.6	8.0	5.2	8.8	7.8	11.1	7.0	4.1	13.7**

Refrigerator (ES)	Homeowners & have unit	10.7	11.6	8.6^	4.4	9.7	8.0	5.9	6.9	9.2	7.8
Consumer electronics											
Television (ES)	Have unit	12.4	8.1	10.8	8.9	11.6	8.5	13.4^	6.2	7.9	13.0
Printer (ES)	Have unit	9.3	7.0	7.9	5.1	8.6	6.1	8.3**	1.3	4.0	9.5
Computer (ES)	Have unit	9.6	5.8	7.0	7.0	8.3	6.4	3.5	1.3	7.8	6.5
Video game console (ES)	Have unit	3.3	3.0	8.5	3.3	5.7	3.1	0	0	0.0	5.3
Light fixtures											
Outdoor light fixtures (ES)	Have unit	5.3^	2.0	3.3	3.0	4.3	2.5	6.4	3.2	0.0	1.3
Indoor light fixtures (ES)	Have unit	4.8^	8.8	9.4**	4.1	7.1	6.5	3.0	4.0	6.5	3.9
Building envelope											
Attic, ceiling, or wall insulation	Homeowners	8.2**	3.7	7.8**	2.8	8.0**	3.3	6.9	5.7	9.1	11.7
Energy efficient or double paned windows	Homeowners	12.7	8.2	7.0	4.8	9.8^	6.5	4.6	8.0	6.5	9.1
Storm windows	Homeowners	1.6	1.6	2.9	1.2	2.3	1.4	1.1	0	0.0	2.6

^a High-efficiency measures defined as an ENERGY STAR® version of a measure that was installed in the past year [denoted by (ES)], or the measure itself (if it is energy-efficient by definition).

** Significantly higher than other treatment group at 95% confidence level.

^ Significantly higher than other treatment group at 90% confidence level.

Table 20. Changes in Measure Installations, Low-Cost Measures

Percentage of eligible customers who purchased or installed high-efficiency measures in past year

Measure	Eligible base	National Grid (electric)		National Grid (gas)		National Grid (all fuels)		WMECo		CLC	
		Part.	Cntl.	Part.	Cntl.	Part.	Cntl.	Post	Pre	Post	Pre
Low-Cost Measures											
Recycled a second refrigerator	Homeowners & have unit	16.5%	11.6%	11.1%	9.7%	13.8%	10.6%	14.9%**	5.7%	5.2%	7.8%
Programmable thermostat	Homeowners	7.0	7.0	5.3	4.0	6.1	5.5	6.9^	1.1	2.6	3.9
Insulated outlets and/or light switches	Homeowners	4.9	3.7	6.6^	3.2	5.7^	3.5	2.3	2.3	0.0	3.9^
Motion sensors	Homeowners	3.7	4.1	3.7	1.6	3.7	2.9	2.3	3.4	0.0	1.3
Energy smart power strips	Everyone	8.0	7.6	4.8	6.4	6.4	7.0	6.0	5.0	9.1	11.7
Weather stripping/caulking around windows/doors	Everyone	14.8	12.7	15.9**	10.0	15.4^	11.4	4.0	9.0	5.2	14.3^
ENERGY STAR light	Everyone	28.4	27.1	28.3	24.0	28.3	25.5	17.0	20.0	18.2	29.9^

bulbs or CFLs											
Low-flow showerheads	Everyone	6.4	8.0	4.8	4.0	5.6	6.0	4.0	2.0	5.2	1.3
Faucet aerators	Everyone	4.4	2.8	2.8	1.6	3.6	2.2	2.0	4.0	0.0	1.3
Water heat wrap	Everyone	0.4	2.8**	2.4	1.6	1.4	2.2	0	1.0	0.0	0.0
Lighting timers	Everyone	3.6	4.8	4.0	2.0	3.8	3.4	3.0^	0	2.6	5.2
Window shades, window insulation, window quilts	Everyone	6.8	8.8	7.6	5.6	7.2	7.2	7.0	3.0	1.3	3.9

** Significantly higher than other treatment group at 95% confidence level.

^ Significantly higher than other treatment group at 90% confidence level.

Table 21. Rebates for Energy-Efficient Measures

	National Grid (electric)		National Grid (gas)		National Grid (all fuel)		WMECo		CLC	
	Part.	Cntl.	Part.	Cntl.	Part.	Cntl.	Post	Pre	Post	Pre
Purchased any rebate-eligible item (as % of total n.)	45.4%**	34.4%	36.8%**	27.9%	41.1%**	31.1%	39.0%	32.0%	37.7%	48.1%
Used rebate (as % of total n.)	13.5%	11.6%	12.8%^	8.0%	13.2%^	9.8%	6.0%	4.0%	15.9%	20.8%
Used rebate (as % of people with at least one eligible purchase)	29.8%	33.7%	34.8%	28.6%	32.0%	31.4%	15.4%	12.5%	41.4%	43.2%
Total n.	250	251	251	250	501	501	51	40	29	37

Note: Please refer to questions PE9a-PE9t in the Appendix for the rebate-eligible items.

** Significantly higher than other treatment group at 95% confidence level.

^ Significantly higher than other treatment group at 90% confidence level.

Table 22. Changes in Daily Behaviors

Percentage of eligible customer who started or increased frequency of the energy-saving behavior in past year

Measure	Eligible base	National Grid (electric)		National Grid (gas)		National Grid (all fuels)		WMECo		CLC	
		Part.	Cntl.	Part.	Cntl.	Part.	Cntl.	Post	Pre	Post	Pre
Hang laundry to dry	Has a dryer	6.5%	4.9%	8.6%	7.2%	7.5%	6.1%	5.3%	4.3%	14.3%^	5.3%
Wash laundry in cold water	Has a washing machine	18.1	16.1	18.5	17.6	18.3	16.8	24.5	20.0	14.3	16.9
Fully load the washing machine	Has a washing machine	16.1	16.9	17.3^	12.0	16.7	14.4	22.4	14.7	10.4	10.4
Fully load the dishwasher	Has a dishwasher	16.6	16.2	16.3	12.4	16.5	14.3	19.7	15.8	12.3	11.0
Turn off lights in unoccupied rooms	Everyone	29.2	25.5	32.3	26.4	30.7^	25.9	50.0**	28.1	26.0	23.4
Use task lighting	Everyone	5.6	4.4	5.2	4.4	5.4	4.4	9.0	4.0	9.1	10.4
Use a lighting timer	Everyone	3.6	7.2^	7.6	5.6	5.6	6.4	5.0	2.0	5.2	5.2
Turn off outside lights by day	Has outside lights	13.5	17.8	18.3	15.9	15.9	16.9	34.0**	19.8	8.0	14.3
Turn off computers when not in use	Has a computer	25.4	22.4	22.2	24.9	23.8	23.6	40.0**	19.5	27.3	20.8
Put computers to sleep	Has a computer	26.7^	19.9	25.1	21.8	25.9^	20.9	28.2	23.4	22.1	16.9
Turn off TVs when not in use	Has TV	19.6	20.6	27.1	21.8	23.4	21.2	41.2**	23.7	22.4	14.3
Turn off video game consoles when not in use	Has game console	22.3	26.7	24.5	26.1	23.3	26.4	45.7	41.7	38.5	21.1
Switch off power strips or unplug devices when not in use	Everyone	12.0	18.3**	18.3	14.0	15.2	16.2	29.0**	10.0	22.1	14.3
Lower window shades, insulation or quilts	Everyone	14.8	15.9	14.7	12.8	14.8	14.4	30.0**	11.2	5.2	7.8
Take short showers	Everyone	16.8	15.9	19.5	18.0	18.2	17.0	32.0**	17.7	13.0	7.8

** Significantly higher than other treatment group (either participant or control) at 95% confidence level.

^ Significantly higher than other treatment group (either participant or control) at 90% confidence level.

Table 23. Changes in Periodic Behaviors

Percentage of eligible customers who started or increased frequency of an energy-saving behavior in past year

Measure	Eligible base	National Grid (electric)		National Grid (gas)		National Grid (all fuels)		WMECo		CLC	
		Part.	Cntl.	Part.	Cntl.	Part.	Cntl.	Post	Pre	Post	Pre
Use a portable window fan	Everyone	9.2%	6.0%	9.6%	10.4%	9.4%	8.2%	11.0%	18.2%	3.9%	7.8%
Maintain your heating and cooling system	Everyone	14.5	16.7	13.2	21.2**	13.8	19.0**	16.0	19.8	13.0	11.7
Change the furnace filter	Has furnace	9.3	7.8	9.1	9.5	9.2	8.6	12.4	19.8	5.3	8.5
Clean the boiler water	Has boiler	4.5	4.3	8.0	9.4	6.3	6.9	2.7	13.2^	2.3	2.4
Reduce water heater temperature	Everyone	9.3	9.2	7.7	12.8^	8.5	11.0	7.0	13.7	11.7	7.8
Clean or replace air filters	Everyone	7.3	8.4	11.8	12.8	9.5	10.6	11.0	17.4	9.1	5.2
Clear the area around vents	Everyone	9.8	15.1^	11.1	15.6	10.4	15.4**	20.0	23.1	7.8	6.5
Make sure refrigerator seals are tight	Everyone	9.8	12.7	13.1	16.0	11.5	14.4	26.0	22.2	7.8	11.7
Clean refrigerator coils	Everyone	7.0	9.6	8.7	12.0	7.8	10.8	16.0	12.4	10.4	6.5
Check the refrigerator temperature	Everyone	11.1	12.7	12.4	12.8	11.7	12.8	23.0	19.5	11.7	15.6
Set the thermostat to recommended set points	Has programmable thermostat	17.0	23.3	28.7	25.0	23.1	24.2	25.5	26.0	18.2	13.2

** Significantly higher than other treatment group (either participant or control) at 95% confidence level.

^ Significantly higher than other treatment group (either participant or control) at 90% confidence level.

7.3 PARTICIPATION IN OTHER CLC PROGRAMS

Our process evaluation also included an examination of participation in other CLC programs to examine potential channeling from SHEMP to other CLC programs. More details can be found in Appendix J. We found key differences between the two pilot groups (Legacy and Energize):

Energize Customers' overall participation in other programs dropped by 36.8% after participation. These participation findings are consistent with the self-reported findings in Chapter 5, where we demonstrate that customers do not appear to be increasing their measure-based actions through programs. Key insights include:

- Most of the cross-program participation among Energize customers was in CLC's Residential Home Energy pilot.
- Although monthly program participation numbers were smaller, cumulative participation in the Residential Home Energy program steadily grew over the pilot participation period, while participation in other CLC programs remained relatively flat.

Legacy customers demonstrated a sharp increase in overall participation during the program participation period, with a 24.7% increase in cross-program participation. Roughly three to six months after pilot participation began (as the participation period started between June and September 2009 for different customers), we observed a sharp increase in cross-program participation. However, this trend leveled off after 12-18 months of treatment.

- Participation in the Residential Products and Services program sharply increased during the pilot period and then similarly began to level off about one year after the increase was observed.
- Participation in the Residential Home Energy program, however, shows a steady increase in overall participation over time.

7.4 IMPACT FINDINGS

7.4.1 Analysis Results

Regression results are presented in Appendix L. Savings estimates are reported in Table 24. Our savings estimates were calculated across two models for each pilot group, and are robust across model specifications, but average about 2% for the 12-month matches and 1.5% for the 24-month matches, though this difference is not statistically significant.³⁴ Savings estimates for Legacy customers are relatively robust to the model specification and the set of matches, averaging about 8.3%.

Based on our estimates, the savings generated for Legacy customers range from 7.8%-8.8%. Comparatively, Energize savings estimates are significantly lower, ranging from 1.49%-1.99% average savings per households.

³⁴ Statements concerning statistical significance refer to Model 1. Estimation of standard errors for Model 2 is not a simple matter and so, given the similarity of results for the two models, we rely on Model 1 for statements about statistical significance and statistical confidence.

Table 24. Estimate of Average Percent Savings During the Pilot Period

	Estimate of Average Percent Savings	Standard Error ^a	t-statistic
Legacy, standard matches, Model 1	7.80%	-0.76%	-10.28
Legacy, standard matches, Model 2	8.35%	-	-
Legacy, low-trend matches, Model 1	8.80%	0.72%	12.28
Legacy, low-trend matches, Model 2	8.21%	-	-
Energize, 24-month matches, Model 1	1.49%	0.63%	2.38
Energize, 24-month matches, Model 2	1.36%	-	-
Energize, 12-month matches, Model 1	1.93%	0.64%	3.00
Energize, 12-month matches, Model 2	1.99%	-	-

^a Standard errors based on clustering of errors at the customer level. The analysis included 77 Legacy customers and 276 Energize customers. The analysis included three matches for each customer.

7.4.2 Discussion of Potential Reasons for Differences between Legacy and Energize Customers

The difference between savings by Legacy and Energize customers is significant, both statistically and practically. We identify three candidate explanations for this, none of which are mutually exclusive:

1. Legacy customers have been in the pilot longer and have “ramped-up” their savings from a lower initial level;
2. Legacy and Energize customers are receiving different treatments;
3. Legacy and Energize customers may be fundamentally different types of households.

Potential Effects of Different Treatments

The latter two explanations are the most likely drivers for the differences we see in savings between the two pilot groups. Unfortunately there is no systematic way to identify the relative roles of these explanations. The two groups are exposed to very different treatments.

To further unearth the potential drivers for these differences as they relate to the pilot tools and tactics, we conducted a literature review for CLC of other feedback technologies and approaches. Based on our review, we found that the following pilot attributes of the Legacy customers may play a role in driving these higher savings numbers. These factors include:

- Push-notifications and/or reports that the customer receives regardless of his or her level of engagement. In this way, even passive customers receive treatment.
- Real-time feedback (less than 15 minute). Programs that offer real-time feedback appear to have higher savings rates.
- Social engagement. Programs that have some form of social engagement, be it competition, rewards, comparisons, etc. appear to be more successful than those that do not engage other customers in their program model.

Potential differences in the target population

Further, we understand that Legacy and Energize customers were targeted differently and that Legacy customers were the earliest adopters of this technology in CLC's region. These differences could be a reason for the differences we see in the savings estimates. However, customers are not very different in terms of the few available observable characteristics. Legacy customers are somewhat higher energy users. In 2008, they averaged 27.9 kWh per day, whereas Energize customers averaged 23.4 kWh per day. The only demographic data available for *both* Legacy and Energize households are the year the participant's home was built, whether the customer has electric heat, and whether the customer is on the residential assistance rate.

7.4.3 Recommendations

Our overall findings suggest two key take-aways:

1. The treatment approach for Legacy customers may be more effective at generating pilot savings; and
2. The current Energize platform may not be providing sufficient feedback and educational material and content to keep participants engaged and taking more action than they were in the pre-period to generate savings comparable to the Legacy cohort.

Our research also suggests that Energize participants are receiving and generally understanding the information that they are presented from the IHD, but they are not always sure what actions to take based on the information they receive. In fact, only one-third (32%) of customers said that they felt they learned new ways to save energy in their home from the IHD information. Further, those who learned new ways to save were significantly more likely to share that information with others. Both our participant survey and our literature have found that information alone is not sufficient to promote action based on receiving energy information displays or visiting the related website. We have identified some ways that CLC can increase customer actions:

- **Add or increase proactive educational pushes for participants, and regularly reach out to them throughout the participation period.** Our survey found that participant engagement with the device often decreases over time, with nearly half (47%) reporting that they look at the device less often after one year of participation. Our literature review also found that in-home display devices are often insufficient for gaining significant per-person savings without PA "pushes" throughout the program period. These educational materials should be designed toward promoting energy-saving action, rather than awareness of usage alone. Information alone is not enough to prompt action. According to our literature review, some effective push tools that PAs have used include normative messaging such as neighbor comparisons and personal benchmarking, as well as ongoing personal feedback reports, online rewards, and customized, seasonally relevant savings tips. Many Legacy participants already receive these educational materials. CLC should consider expanding these reports to Energize customers.
- **Focus on more sophisticated and deeper behavior change in educational materials.** A high number of respondents indicated that they had already installed high efficiency measures before they participated in the IHD pilot, with no detectable increase in their actions after participating in SHEMP Energize. Further, there were few significant differences in energy conservation behaviors during the pilot period.
- **Identify and differentiate pilot strategies based on engagement.** Participants are not uniform in the level of engagement with the device information. While many reported looking at the

device less often, many (41%) looked at it about as often and a few (8%) said they looked at it more often.

- **Target less engaged participants with motivational appeals and pushes.** Less engaged participants may need more active reminders, pushes, or challenges to prompt action. SHEMP should consider ways to provide specific outreach to customers with lower levels of overall engagement.
- **Consider methods to better promote and integrate IHD information more with the program website.** Our literature review found that website engagement can help increase per-customer and overall savings, but our survey found that only about half of participants use the website (54%), and that only about one in five customers said that they used the website once a month or more (19%). Website content could be made more dynamic to offer information on predicted billing or tips based on current usage. Our literature review found that interactive components particularly help increase customer engagement in the website and take savings based on feedback.

To increase per-person savings, consider some targeting of high-usage customers. For the Legacy pilot, Cape Light Compact targeted high-usage customers (monthly usage over 650 kWh) for their participant pool. No such targeting was included in the Energize pilot. We found in our literature review that targeting customers, particularly high-usage customers, often produced higher per-customer savings, especially when partnered with ongoing engagement pushes from the PAs. Increased targeting of these customers may increase per-person savings within this group, and in turn increase overall savings.

A. DETAILED OPOWER PROGRAM IMPACTS

This section details the results from the OPOWER impact analysis for the all three program years (2009-2012).

Table 25. Comparative Energy Savings Impacts Summary

#	Model Type	Program Administrator	Implementer	Cohort	Fuel Type	Program Year	Total Evaluated Participants	Base Usage	Modeled Base Usage*	Net Savings per HH*	Net Savings % per HH
1	Opt-out	National Grid	OPOWER	2009	Electric	PY1	24,853	10,877 kWh	11,429 kWh	184 kWh	1.61%
2	Opt-out	National Grid	OPOWER	2009	Electric	PY2	23,309	10,825 kWh	10,825 kWh	223 kWh	2.06%
3	Opt-out	National Grid	OPOWER	2009	Electric	PY3	21,155	10,824 kWh	11,044 kWh	263 kWh	2.38%
4	Opt-out	National Grid	OPOWER	2010	Electric	PY1	68,194	12,133 kWh	11,603 kWh	152 kWh	1.31%
5	Opt-out	National Grid	OPOWER	2010	Electric	PY2	67,980	12,051 kWh	11,329 kWh	196 kWh	1.73%
6	Opt-out	National Grid	OPOWER	2010	Electric	PY3	62,305	12,033 kWh	12,195 kWh	260 kWh	2.13%
7	Opt-out	National Grid	OPOWER	2010 Add	Electric	PY1	23,427	15,008 kWh	14,545 kWh	240 kWh	1.65%
8	Opt-out	National Grid	OPOWER	2010 Add	Electric	PY2	21,224	15,132 kWh	14,766 kWh	284 kWh	1.92%
9	Opt-out	National Grid	OPOWER	2011	Electric	PY1	94,322	9,767 kWh	9,781 kWh	134 kWh	1.37%
10	Opt-out	National Grid	OPOWER	2011	Electric	PY2	82,417	9,765 kWh	9,456 kWh	240 kWh	2.54%
11	Opt-out	National Grid	OPOWER	2011 Add	Electric	PY1	55,055	6,028 kWh	4,627 kWh	56 kWh	1.22%
12	Opt-out	National Grid	OPOWER	2012 Duel Fuel	Electric	PY1	12,074	6,262 kWh	4,615 kWh	44 kWh	0.95%
13	Opt-out	National Grid	OPOWER	2012	Electric	PY1	79,064	6,033 kWh	5,804 kWh	60 kWh	1.03%
14	Opt-out	National Grid	OPOWER	2009	Gas	PY1	24,994	136.5 MMBtus	128.4 MMBtus	1.04 MMBtus	0.81%
15	Opt-out	National Grid	OPOWER	2009	Gas	PY2	23,685	137.2 MMBtus	137.6 MMBtus	1.72 MMBtus	1.25%
16	Opt-out	National Grid	OPOWER	2009	Gas	PY3	19,408	115 MMBtus	100.2 MMBtus	1.92 MMBtus	1.62%
17	Opt-out	National Grid	OPOWER	2010	Gas	PY1	74,759	139.9 MMBtus	139.7 MMBtus	1.69 MMBtus	1.21%
18	Opt-out	National Grid	OPOWER	2010	Gas	PY2	69,750	116.9 MMBtus	90.2 MMBtus	2.09 MMBtus	1.97%
19	Opt-out	National Grid	OPOWER	2011	Gas	PY1	87,691	102.7 MMBtus	103.0 MMBtus	1.02 MMBtus	0.99%
20	Opt-out	National Grid	OPOWER	2011	Gas	PY2	80,472	87.4 MMBtus	64.5 MMBtus	1.02 MMBtus	1.34%

Detailed OPOWER Program Impacts

#	Model Type	Program Administrator	Implementer	Cohort	Fuel Type	Program Year	Total Evaluated Participants	Base Usage	Modeled Base Usage*	Net Savings per HH*	Net Savings % per HH
21	Opt-out	National Grid	OPOWER	2011 Add	Gas	PY1	25,048	54.3 MMBtus	57.5 MMBtus	0.30 MMBtus	0.51%
22	Opt-out	National Grid	OPOWER	2011 Dual Fuel	Gas	PY1	13,052	69.8 MMBtus	56.0 MMBtus	0.30 MMBtus	0.55%
23	Opt-out	National Grid	OPOWER	2012	Gas	PY1	83,938	69.8 MMBtus	72.7 MMBtus	0.83 MMBtus	1.14%
24	Opt-out	NSTAR	OPOWER	Wave I	Gas	PY1 ^a	23,247	104 MMBtus	110.4 MMBtus	1.48 MMBtus	1.34%
25	Opt-out	NSTAR	OPOWER	Wave I	Gas	PY1 ^a	22,840	55.7 MMBtus	54.1 MMBtus	0.53 MMBtus	0.98%
26	Opt-out	NSTAR	OPOWER	Wave I	Gas	PY2	21,599	111.5 MMBtus	96.9 MMBtus	0.75 MMBtus	0.95%
27	Opt-out	NSTAR	OPOWER	Wave II	Gas	PY1	22,108	121.5 MMBtus	119.0 MMBtus	1.82 MMBtus	1.53%
28	Opt-out	NSTAR	OPOWER	Wave II	Gas	PY2	20,415	99.7 MMBtus	87.9 MMBtus	1.12 MMBtus	1.55%
29	Opt-out	NSTAR	OPOWER	Wave III	Electric	PY1	59,030	13,786 kWh	10,180 kWh	134 kWh	1.32%
30	Opt-out	NSTAR	OPOWER	Wave IV	Electric	PY1	17,514	10,768 kWh	5,325 kWh	67 kWh	1.25%
<p>* The Net savings per household are estimated using the modeled baseline usage. The modeled baseline usage could be different than the actual baseline usage for two reasons: (1) data cleaning of participants to include in the model and (2) the modeled baseline takes into account both the treatment and control group pre-program usage and the modeled residual (as opposed to the actual baseline which is calculated using only the treatment group pre-program usage)</p> <p>^a Over less than a full year (May 2010-December 2011)</p>											

Table 26. Cross-Program Participation and Associated Savings among Behavioral Program Participants

Model Type	Implementer	Cohort	Fuel Type	Program Year	% of Customers Participated at Least Once in other Programs	% of Total Savings per HH Associated with Cross-Program Participation
Opt-out	OPOWER	2009	Electric	PY1	--	--
Opt-out	OPOWER	2009	Electric	PY2	0.25%	--
Opt-out	OPOWER	2009	Electric	PY3	0.36%	0.17%
Opt-out	OPOWER	2010	Electric	PY1	0.85%	0.06%
Opt-out	OPOWER	2010	Electric	PY2	0.26%	0.10%
Opt-out	OPOWER	2010	Electric	PY3	0.38%	0.01%
Opt-out	OPOWER	2010 Add	Electric	PY1	0.77%	0.05%
Opt-out	OPOWER	2010 Add	Electric	PY2	0.94%	0.22%
Opt-out	OPOWER	2011	Electric	PY1	--	--
Opt-out	OPOWER	2011	Electric	PY2	0.07%	0.06%
Opt-out	OPOWER	2011 Add	Electric	PY1	0.14%	0.08%
Opt-out	OPOWER	2012 Dual Fuel	Electric / Gas	PY1	0.3%	0.06%
Opt-out	OPOWER	2012	Electric	PY1	0.34%	0.05%
Opt-out	OPOWER	2009	Gas	PY1	--	--
Opt-out	OPOWER	2009	Gas	PY2	0.37%	--
Opt-out	OPOWER	2009	Gas	PY3	1.35%	0.19%
Opt-out	OPOWER	2010	Gas.	PY1	--	--
Opt-out	OPOWER	2010	Gas.	PY2	1.94%	0.18%
Opt-out	OPOWER	2011	Gas	PY1	0.68%	--
Opt-out	OPOWER	2011	Gas	PY2	1.04%	0.16%
Opt-out	OPOWER	2011 Add	Gas	PY1	0.33%	0.00%
Opt-out	OPOWER	2011 Dual Fuel	Electric / Gas	PY1	NA ^a	0.04%
Opt-out	OPOWER	2012	Gas	PY1	1.04%	0.005%
Opt-out	OPOWER	Wave I	Gas	PY1	0.81%	0.04%
Opt-out	OPOWER	Wave I	Gas	PY2	-0.20%	0.01%
Opt-out	OPOWER	Wave II	Gas	PY1	0.97%	0.03%
Opt-out	OPOWER	Wave II	Gas	PY2	0.21%	0.03%
Opt-out	OPOWER	Wave III	Electric	PY1	0.81%	0.24%
Opt-out	OPOWER	Wave IV	Electric	PY1	0.59%	0.23%

^a Cross program participation for the dual fuel cohort was calculated together and is shown once. However, savings adjustments were calculated based on fuel type.

^b Cross-program participation analysis was not conducted for the C3 program in the PY2 evaluation year. As such, only this evaluation year results are shown.

Table 27 presents the National Grid impact results for their Electric Home Energy Report program.

Table 27. National Grid Net Home Energy Report Savings by Cohort and Program Year – Electric

Cohort	OPOWER Group 2009			OPOWER Group 2010			OPOWER Group 2010 Add		OPOWER Group 2011		OPOWER Group 2011 Add	OPOWER Group 2012 Dual Fuel	OPOWER Group 2012
Program Year	Y1	Y2	Y3	Y1	Y2	Y3	Y1	Y2	Y1	Y2	Y1	Y1	Y1
Program Administrator-Defined Program Year ³⁵	Oct-09--Sep-10	Oct-10--Sep-11	Oct-11--Sep-12	Feb-10--Jan-11	Feb-11--Jan-12	Feb-12--Jan-13	Oct-10--Sep-11	Oct-11--Sep-12	Jan-11--Dec-11	Jan-12--Dec-12	Oct-11--Sep-12	Dec-11--Nov-12	Jan-12--Dec-12
First Report Date (Average)	1-Oct-09	1-Oct-09	1-Oct-09	23-Jan-10	23-Jan-10	23-Jan-10	7-Dec-10	7-Dec-10	30-Jan-11	30-Jan-11	21-Nov-11	26-Dec-11	24-Dec-11
Total Evaluated Participants	24,853	23,309	21,155	68,194	67,980	62,305	23,427	21,224	94,322	82,417	55,055	12,074	79,064
Actual Baseline Usage (kWh) ³⁶	10,877	10,825	10,824	12,133	12,051	12,033	15,008	15,132	9,767	9,765	6,028	6,262	6,033
Modeled Baseline Usage (kWh)	NA	NA	11,044	NA	NA	12,195	NA	14,766	NA	9,456	4,627	4,615	5,804
Net Program Savings from LFER (% per HH)	1.61%	2.06%	2.38%	1.31%	1.73%	2.13%	1.65%	1.92%	1.37%	2.54%	1.22%	0.95%	1.03%
90% Confidence Interval Lower Bound ³⁷	1.38%	1.80%	1.89%	1.10%	1.50%	1.69%	1.30%	1.42%	1.20%	2.07%	0.92%	0.93%	0.97%
90% Confidence Interval Upper Bound	1.84%	2.30%	2.88%	1.50%	1.90%	2.57%	2.00%	2.43%	1.60%	3.01%	1.38%	1.50%	1.44%
Net Savings (Delta kWh)	184	223	263	152	196	260	240	284	134	240	56	44	60
Incremental Savings from Other Programs (% per HH)	0.00%	0.00%	0.17%	0.06%	0.10%	0.01%	0.05%	0.22%	0.00%	0.06%	0.08%	0.06%	0.05%
Final Adjusted Net Savings (% per HH)	1.61%	2.06%	2.21%	1.25%	1.63%	2.12%	1.60%	1.70%	1.37%	2.47%	1.14%	0.89%	0.98%
Final Adjusted Net Savings (Delta kWh)	184	223	244	145	185	258	233	251	134	234	53	41	57

³⁵ These dates represent the Program Administrator (PA)-defined program years. These dates typically start on the month in which the majority of mailings began and continue for 12 months.

³⁶ Baseline usage is calculated by annualizing average daily usage in the pre-period months that were included in the analysis.

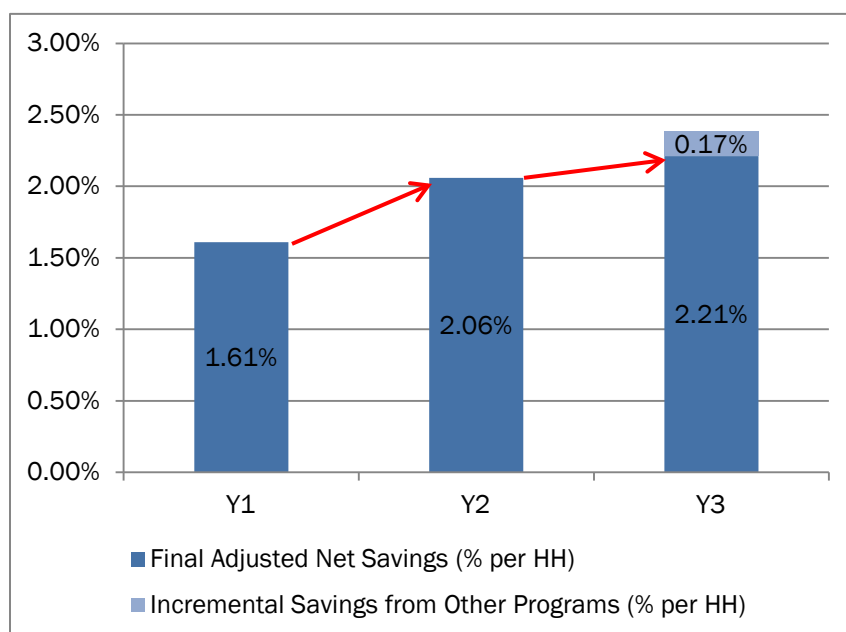
³⁷ The confidence intervals in this evaluation, when divided by the savings estimates provide the relative precision numbers. However, it is important to note that the confidence bounds reflect standard errors that must be interpreted differently in this evaluation than in evaluations where we are estimating impacts based on samples. The OPOWER program participants cannot reasonably be considered a sample; each cohort is a population of program participants, and thus, standard errors, confidence intervals, and precision estimates cannot be interpreted in the usual way.

OPOWER Group 2009 led to savings in all program years (PY1, PY2 and PY3). This cohort saved an average annual net savings of 1.61% per household in PY1 (October 2009-September 2010), 2.06% in PY2 (October 2010-September 2011) and 2.38% in PY3 (October 2011-September 2012), indicating that savings are persisting and possibly growing over time. The percent saved per household amounts to an overall net kWh reduction of 263 kWh per household in PY3.

- Our channeling analysis found that 0.17% of savings are associated with the other programs for the pilot group in PY3. The initial estimate of program savings from the LFER was 2.38% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 2.21% per household with an overall net adjusted kWh reduction of 244 kWh per household.

In Figure 42, we see that adjusted net savings increased to 2.21% from 2.06% during the second program year and from 1.61% during the first program year for the National Grid Electric Group 2009.

Figure 42. Persistence in Savings for Electric OPOWER Group 2009



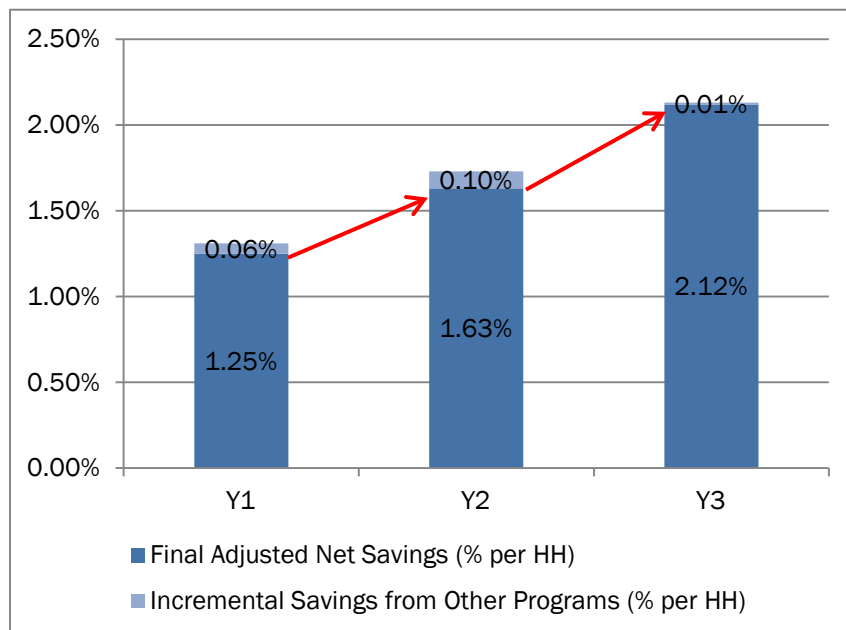
OPOWER Group 2010 led to savings in all program years (PY1, PY2 and PY3). This cohort saved an average annual net savings of 1.31% per household in PY1 (February 2010-January 2011), 1.73% in PY2 (February 2011-January 2012) and 2.13% in PY3 (February 2012-January 2013), indicating that savings are persisting and possibly growing over time. The percent saved per household amounts to an overall net kWh reduction of 260 kWh per household in PY3.

- In each program year, we found statistically significant savings due to other programs in our channeling analysis.
 - In PY3 the channeling analysis found that 0.01% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 2.13% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 2.12% per household with an overall net adjusted kWh reduction of 258 kWh per household.

- The LFER-based savings for PY2 were 1.73%. After adjusting for participation in other programs, the adjusted net savings were 1.63%.
- The LFER-based savings for PY1 were 1.31%. After adjusting for participation in other programs, the adjusted net savings were 1.25%.

In Figure 43. Persistence in Savings for Electric OPOWER Group 2010, we see that adjusted net savings increased to 2.12% from 1.63% during the second program year and from 1.25% during the first program year for the National Grid Electric Group 2010.

Figure 43. Persistence in Savings for Electric OPOWER Group 2010

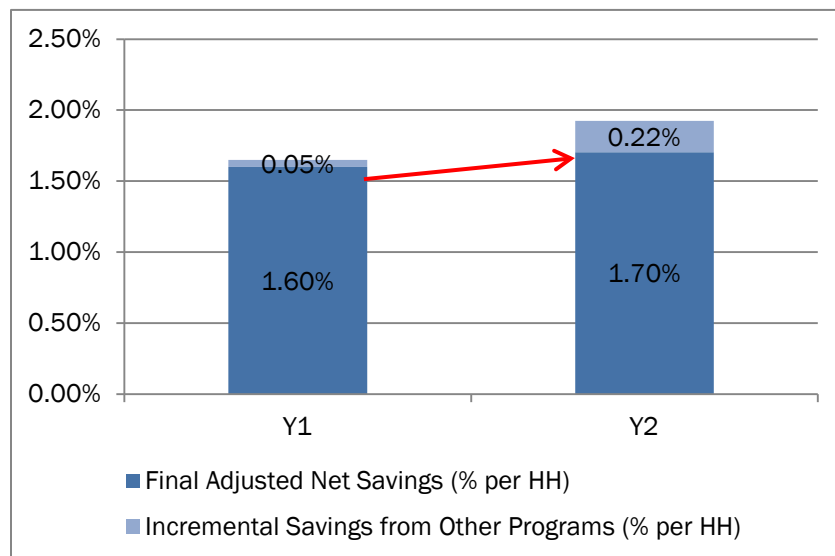


OPOWER Group 2010 Add led to savings in both PY1 (October 2010-September 2011) and PY2 (October 2011-September 2012). This cohort saved an average annual net savings of 1.65% per household in PY1 resulting in an annual reduction of 240 kWh per household and an average annual net savings of 1.92% per household in PY2 resulting in an annual reduction of 284 kWh per household.

- In each program year, we found statistically significant savings due to other programs in our channeling analysis.
 - In PY2 the channeling analysis found that 0.22% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 1.92% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 1.70% per household with an overall net adjusted kWh reduction of 251 kWh per household.
 - The PY1 net program savings from the LFER were 1.65%. The net savings adjusted for participation in other programs resulted in adjusted net savings of 1.60%.

In Figure 44, we see that adjusted net savings increased to 1.70% from 1.60% during the first program year for the National Grid Electric Group 2010 Add.

Figure 44. Persistence in Savings for Electric OPOWER Group 2010 Add

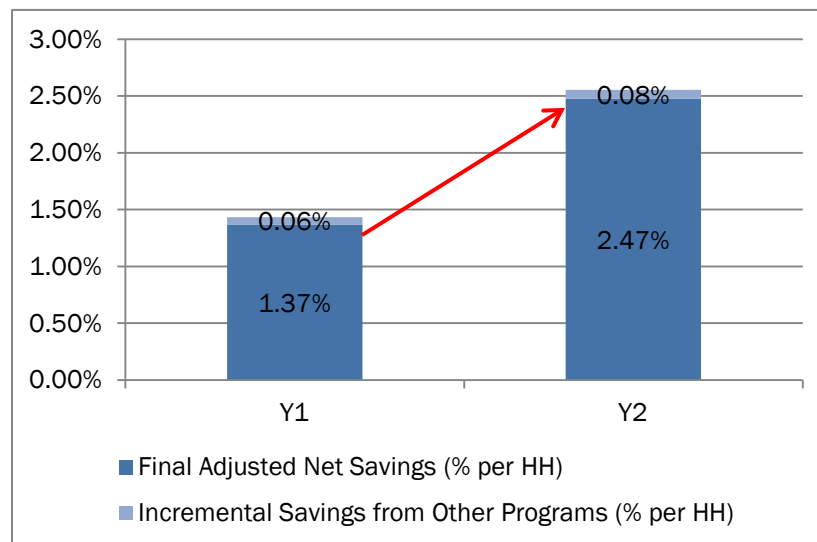


OPOWER Group 2011 led to savings in both PY1 (January 2011-December 2011) and PY2 (January 2011-December 2012). This cohort saved an average annual net savings of 1.37% per household in PY1 resulting in an annual reduction of 134 kWh per household and an average annual net savings of 2.54% per household in PY2 resulting in an annual reduction of 240 kWh per household.

- The PY1 net program savings from the LFER were 1.37%. The net savings adjusted for participation in other programs were not statistically significant, so the final net savings figure remains 1.37%.
- However, in PY2 we found statistically significant savings due to other programs in our channeling analysis.
 - In PY2 the channeling analysis found that 0.06% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 2.54% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 2.47% per household with an overall net adjusted kWh reduction of 234 kWh per household.

In Figure 45Figure 44, we see that adjusted net savings increased to 2.47% from 1.37% during the first program year for the National Grid Electric Group 2011.

Figure 45. Persistence in Savings for Electric OPOWER Group 2011



OPOWER Group 2011 Add led to savings in PY1 (October 2011-September 2012). This cohort saved an average annual net savings of 1.22% per household in PY1 resulting in an annual reduction of 56 kWh per household.

- In PY1, we found statistically significant savings due to other programs in our channeling analysis.
 - In PY1 the channeling analysis found that 0.08% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 1.22% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 1.14% per household with an overall net adjusted kWh reduction of 53 kWh per household.

OPOWER Group 2012 Dual Fuel led to savings in PY1 (December 2011-November 2012). This cohort saved an average annual net savings of 0.95% per household in PY1 resulting in an annual reduction of 44 kWh per household.

- In PY1, we found statistically significant savings due to other programs in our channeling analysis.
 - In PY1 the channeling analysis found that 0.06% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 0.95% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 0.89% per household with an overall net adjusted kWh reduction of 41 kWh per household.

OPOWER Group 2012 led to savings in PY1 (January 2011-December 2012). This cohort saved an average annual net savings of 1.03% per household in PY1 resulting in an annual reduction of 60 kWh per household.

- In PY1, we found statistically significant savings due to other programs in our channeling analysis.

In PY1 the channeling analysis found that 0.05% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 1.03% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 0.98% per household with an overall net adjusted kWh reduction of 57 kWh per household.

Table 28 presents the National Grid impact results for their Gas Home Energy Report program.

Table 28. National Grid Net Home Energy Report Savings by Cohort and Program Year – Gas

Cohorts	OPOWER Group 2009 Pilot			OPOWER Group 2010		OPOWER Group 2011		OPOWER Group 2011 Add	OPOWER Group 2011 Dual Fuel	OPOWER Group 2012
Program Year	Y1	Y2	Y3	Y1	Y2	Y1	Y2	Y1	Y1	Y1
Program Administrator-Defined Program Year ³⁸	Oct-09–Sep-10	Oct-10–Sep-11	Oct-11–Sep-12	Oct-10–Sep-11	Oct-11–Sep-12	Jan-11–Dec-11	Jan-12–Dec-12	Nov-11–Oct-12	Dec-11–Nov-12	Jan-12–Dec-12
First Report Date (Average)	30-Sep-09	30-Sep-09	30-Sep-09	6-Nov-10	6-Nov-10	31-Jan-11	31-Jan-11	15-Dec-11	27-Dec-11	26-Dec-12
Total Evaluated Participants	24,994	23,685	19,408	74,759	69,750	87,691	80,472	25,048	13,052	83,938
Actual Baseline Usage (MMBtu) ³⁹	136.5	137.2	115.0	139.9	116.9	102.7	85.8	62.8	69.6	70.0
Modeled Baseline Usage (MMBtu)	NA	NA	100.2	NA	90.2	NA	65.4	57.5	56.0	72.7
Net Program Savings from LFER (% per HH)	0.81%	1.25%	1.62%	1.21%	1.97%	0.99%	1.34%	0.51%	0.55%	1.14%
90% Confidence Interval Lower Bound ⁴⁰	0.63%	1.10%	0.80%	1.00%	1.02%	0.50%	0.22%	-0.29%	-0.42%	0.67%
90% Confidence Interval Upper Bound	0.99%	1.40%	2.43%	1.50%	2.92%	1.50%	2.45%	1.31%	1.52%	1.61%
Net Savings (Delta MMBtu)	1.04	1.72	1.92	1.698	2.09	1.02	1.02	0.30	0.30	0.83
Incremental Savings from Other Programs (% per HH)	0.00%	0.00%	0.19%	0.00%	0.18%	0.00%	0.16%	0.00%	0.04%	0.005%
Final Adjusted Net Savings (% per HH)	0.81%	1.25%	1.43%	1.21%	1.80%	0.99%	1.18%	0.51%	0.50%	1.13%
Final Adjusted Net Savings	1.04	1.72	1.69	1.70	1.90	1.02	0.89	0.30	0.28	0.82

³⁸ The start of the program period is defined by the month in which mailings began, though the program date 12 month savings start may begin in a later month (typically a month after a participant receives their first report).

³⁹ Baseline usage is calculated by annualizing average daily usage in the pre-period months that were included in the analysis.

⁴⁰ The confidence intervals in this evaluation, when divided by the savings estimates, provide the relative precision numbers. However, it is important to note that the confidence bounds reflect standard errors that must be interpreted differently in this evaluation than in evaluations where we are estimating impacts based on samples. The OPOWER program participants cannot reasonably be considered a sample; each cohort is a population of program participants, and thus, standard errors, confidence intervals, and precision estimates cannot be interpreted in the usual way. This includes those cases (Group 2011 add and Group 2011 Dual Fuel) where the confidence interval covers zero. This should not be taken to mean that there were zero savings for that cohort. The savings calculated are the best estimate we have for the impact of that program and should be interpreted in that way.

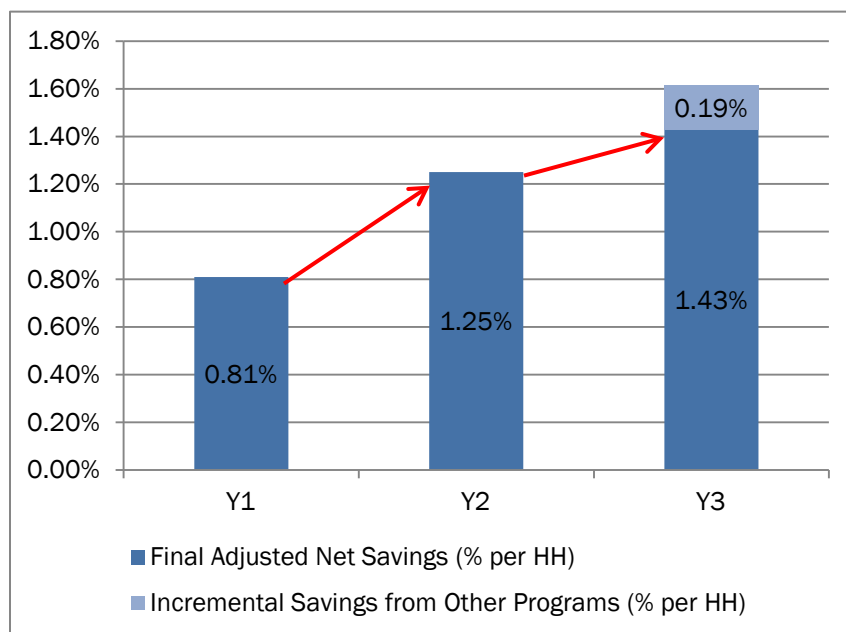
(Delta MMBtu)										
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OPOWER Group 2009 trended similarly to the Electric cohort, with savings persisting and trending higher in PY3 (October 2011-September 2012) as compared to PY2 (October 2010-September 2011) and PY1 (October 2009-September 2010). This cohort saved an average annual net savings of 0.81% per household in PY1, 1.25% in PY2 and 1.62% in PY3. The percent saved per household amounts to an overall net reduction of 1.92 MMBtus per household in PY3.

- Our channeling analysis found that 0.19% of savings are associated with the other programs for the pilot group in PY3. The initial estimate of program savings from the LFER was 1.62% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 1.43% per household with an overall net adjusted kWh reduction of 1.69 MMBtus per household.

In Figure 46, we see that adjusted net savings increased to 1.43% from 1.25% during the second program year and from 0.81% during the first program year for the National Grid Gas Group 2009.

Figure 46. Persistence in Savings for Gas OPOWER Group 2009

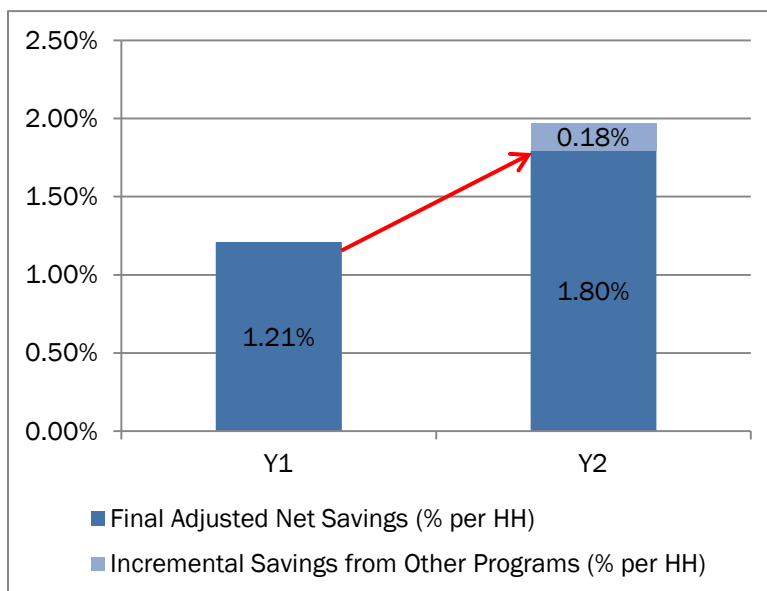


OPOWER Group 2010 saved about the same MMBtus as the PY2 Pilot (OPOWER Group 2009), with an average adjusted net savings of 1.21% per household in PY1 (October 2010-September 2011). However, this cohort had higher savings in PY2 (October 2011-September 2012) with an average adjusted net savings of 1.97% per household. These average household savings amounted to a reduction of 2.09 MMBtus per household in PY2.

- The PY2 channeling analysis showed statistically significant savings due to other programs for this cohort.
 - In PY2 the channeling analysis found that 0.18% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 1.97% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 1.80% per household with an overall net adjusted kWh reduction of 1.90 MMBtus per household.

In Figure 47, we see that adjusted net savings increased to 1.80% from 1.21% during the first program year for the National Grid Gas Group 2010.

Figure 47. Persistence in Savings for Gas OPOWER Group 2010

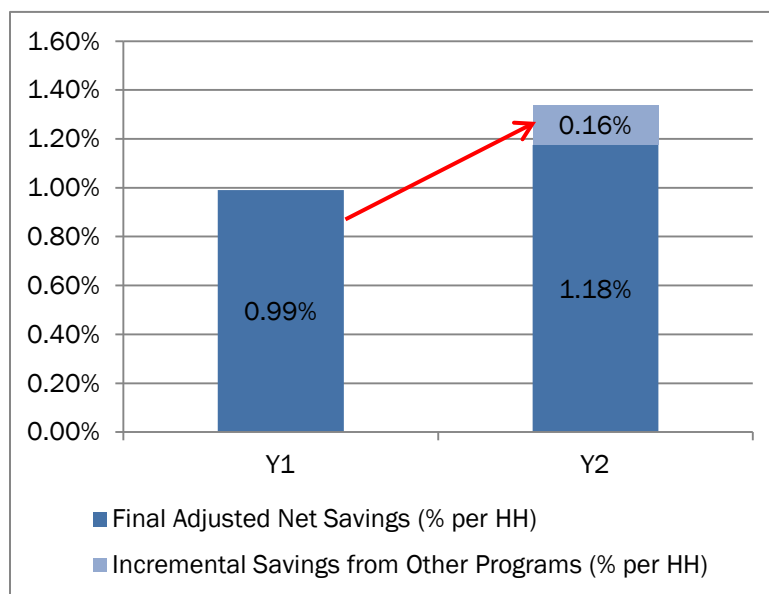


OPOWER Group 2011 saved an average adjusted net savings of 0.99% per household in PY1 (January 2011-December 2011) and an average adjusted net savings of 1.34% per household in PY2 (January 2012-December 2012). These average household savings amounted to a reduction of 1.02 MMBtus per household in PY2.

- The PY2 channeling analysis showed statistically significant savings due to other programs for this cohort.
 - In PY2 the channeling analysis found that 0.16% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 1.34% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 1.18% per household with an overall net adjusted kWh reduction of 0.89 MMBtus per household.

In Figure 48, we see that adjusted net savings increased to 1.18% from 0.99% during the first program year for the National Grid Gas Group 2011.

Figure 48. Persistence in Savings for Gas OPOWER Group 2011



OPOWER Group 2011 Add led to savings in PY1 (November 2011-October 2012). This cohort saved an average annual net savings of 0.51% per household in PY1 resulting in an annual reduction of 0.34 MMBTUs per household.

- In PY1, no statistically significant savings were found due to other programs in our channeling analysis.

OPOWER Group 2011 Dual Fuel led to savings in PY1 (December 2011-November 2012). This cohort saved an average annual net savings of 0.55% per household in PY1 resulting in an annual reduction of 0.3 MMBTUs per household.

- In PY1, we found statistically significant savings due to other programs in our channeling analysis.
 - In PY1 the channeling analysis found that 0.04% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 0.55% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 0.50% per household with an overall net adjusted kWh reduction of 0.28 MMBtus per household.

OPOWER Group 2012 led to savings in PY1 (November 2011-October 2012). This cohort saved an average annual net savings of 1.14% per household in PY1 resulting in an annual reduction of 0.83 MMBTUs per household.

- In PY1, we found statistically significant savings due to other programs in our channeling analysis.

In PY1 the channeling analysis found that 0.005% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 1.14% prior to looking at participation in other programs. Because the savings from participation in other programs were

statistically significant, the final net savings figure is adjusted to 1.13% per household with an overall net adjusted kWh reduction of 0.82 MMBtus per household.

Table 29 presents the NSTAR impact findings results for the Gas Home Energy Reports program.

Table 29. NSTAR Net Home Energy Report Savings by Cohort and Program Year – Gas

NSTAR Gas	Wave 1			Wave 2	
Program Year	Y1^	Y1	Y2	Y1	Y2
Program Administrator-Defined Program Year ⁴¹	Aug-10-Apr-11	May-11-Dec-11	Jan-12-Dec-12	Feb-11-Jan12	Jan-12-Dec-12
First Report Date (Average)	31-Aug-10	31-Aug-10	31-Aug-10	31-Jan-11	31-Jan-11
Total Evaluated Participants	23,247	22,840	21,599	22,108	20,415
Actual Baseline Usage (MMBTU) ⁴²	104.00	55.70	111.46	121.50	99.65
Modeled Baseline Usage (MMBTU)	NA	NA	96.89	NA	87.89
Net Program Savings from LFER (% per HH)	1.34%	0.98%	0.95%	1.53%	1.55%
90% Confidence Interval Lower Bound ⁴³	1.16%	-0.10%	0.71%	0.80%	1.23%
90% Confidence Interval Upper Bound	1.52%	2.03%	1.19%	2.30%	1.87%
Net Savings (Delta MMBTU)	1.48	0.53	0.75	1.82	1.12
Incremental Savings from Other Programs (% per HH)	0.00%	0.04%	0.01%	0.03%	0.03%
Final Adjusted Net Savings (% per HH)	1.34%	0.94%	0.94%	1.50%	1.52%
Final Adjusted Net Savings (Delta MMBTU) ⁴⁴	1.48	0.51	0.74	1.78	1.10

^ Previously evaluated but not included in the 2010 Annual Report

⁴¹ The start of the program period is defined by the month in which mailings began, though the program treatment period may begin in a later month (typically a month after a participant receives their first report).

⁴² Baseline usage is calculated by adjusting average daily usage in the pre-period months that were included in analysis to the number of days included in the treatment period. For OPOWER Group 2010, baseline usage is less than a full year, while Group 2011 is annualized.

⁴³ The confidence intervals in this evaluation, when divided by the savings estimates, provide the relative precision. However, it is important to note that the confidence bounds reflect standard errors that must be interpreted differently in this evaluation than in evaluations where we are estimating impacts based on samples. The OPOWER program participants cannot reasonably be considered a sample; each cohort is a population of program participants, and thus, standard errors, confidence intervals, and precision estimates cannot be interpreted in the usual way.

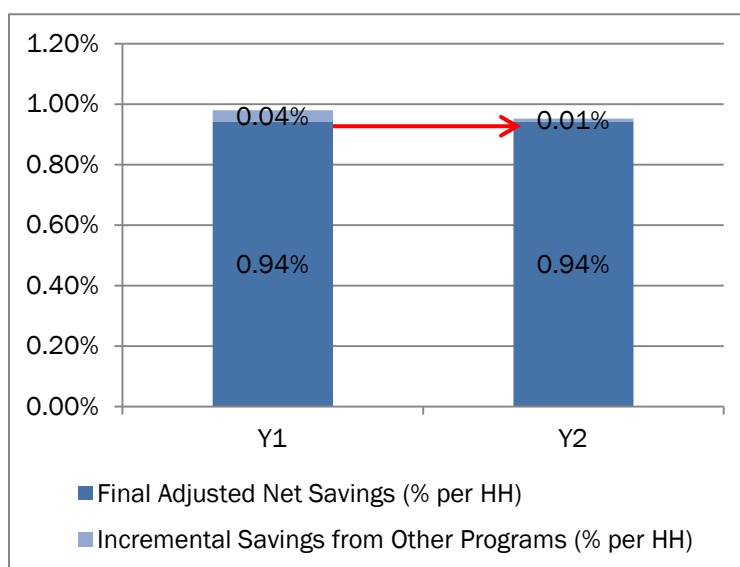
⁴⁴ For each part of Group 2010, savings apply to the treatment period, which is less than a full year. For Group 2011, the data are annualized using the data available to the evaluation team, and thus represent a full year of savings. Notably, not all programs were implemented for the full 2011 program year. In cases where the program did not start in January 2011, some of these “annual savings” occur in 2012.

Wave 1 of the NSTAR program was previously evaluated from August 2010- to April 2011 and shown to have an average net savings of 1.34% per household and from May 2011-December 2011 showed an average net savings of 0.94%. In PY2 (January 2012-December 2012) this cohort saved an average annual net savings of 0.94%, resulting in an annual reduction of 0.74 MMBtus per household. As such, the saving over time seem to have stabilized for this cohort.

- Our channeling analysis found statistically significant savings due to other program participation for Wave 1 participants.
 - In PY2 the channeling analysis found that 0.01% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 0.95% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 0.94% per household with an overall net adjusted kWh reduction of 0.74 MMBtus per household.
 - The PY1 net program savings from the LFER were 0.98% and the net savings adjusted for participation resulted in adjusted net savings of 0.94%.

In Figure 49, we see that adjusted net savings stabilized at 0.94% during the first and second program year for the NSTAR Gas Wave 1.

Figure 49. Persistence in Savings for Gas Wave 1



Wave 2 participants saved an average net of 1.53% per household in PY1 (February 2011-January 2012) and an average net of 1.55% per household in PY2 (January 2012-December 2012). These average household savings amounted to a reduction of 1.12 MMBtus per household in PY2.

- Our channeling analysis found statistically significant savings due to other program participation for Wave II participants.
 - In PY2 the channeling analysis found that 0.03% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 1.55% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is

adjusted to 1.52% per household with an overall net adjusted kWh reduction of 1.1 MMBtus per household.

- The PY1 net program savings from the LFER were 1.53% and the net savings adjusted for participation resulted in adjusted net savings of 1.50%.

In Figure 50, we see that adjusted net savings increased slightly to 1.52% during the second year from 1.50% in the first program year for the NSTAR Gas Wave 2.

Figure 50. Persistence in Savings for Gas Wave 2

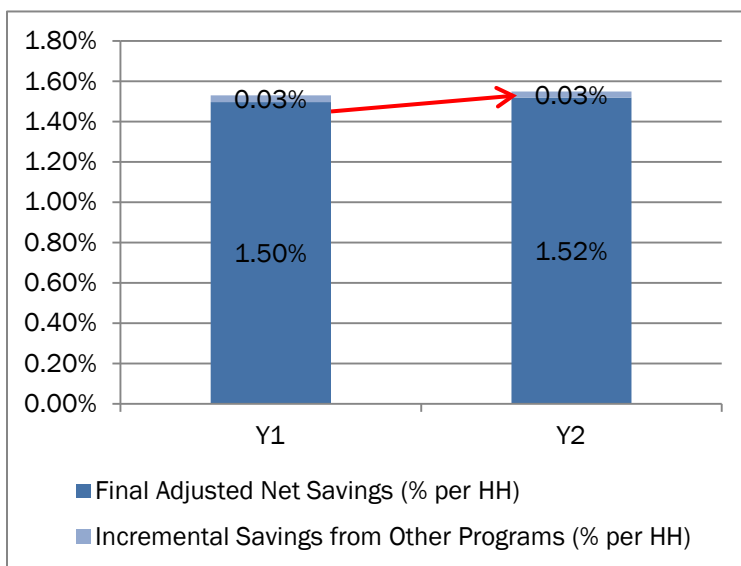


Table 30 presents the NSTAR impact findings results for the Electric Home Energy Reports program. These cohorts were launched after the beginning of the program cycle (the first report for Wave 3 was sent out beginning in March and for Wave 3 beginning in May), as such the impact analysis results are based on partial year information.

Table 30. NSTAR Net Home Energy Report Savings by Cohort and Program Year – Electric

NSTAR Electric	Wave 3	Wave 4
Program Year	Y1	Y1
Program Administrator-Defined Program Year ⁴⁵	Jan-11-Dec-12	Jan-11-Dec-12
First Report Date (Average)	6-Mar-12	11-Jun-12
Total Evaluated Participants	59,030	17,514
Actual Baseline Usage (kWh) ⁴⁶	13,786	10,768
Modeled Baseline Usage (kWh)	10,180	5,325
Net Program Savings from LFER (% per HH)	1.32%	1.25%
90% Confidence Interval Lower Bound ⁴⁷	1.12%	0.91%
90% Confidence Interval Upper Bound	1.52%	1.60%
Net Savings (Delta kWh)	134	67
Incremental Savings from Other Programs (% per HH)	0.24%	0.23%
Final Adjusted Net Savings (% per HH)	1.08%	1.02%
Final Adjusted Net Savings (Delta kWh) ⁴⁸	110	54

Wave 3 led to savings in PY1 (January 2011-December 2012). This cohort saved an average annual net savings of 1.32% per household in PY1 resulting in an annual reduction of 134 kWh per household.

- In PY1, we found statistically significant savings due to other programs in our channeling analysis.
 - In PY1 the channeling analysis found that 0.24% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 1.32% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 1.08% per household with an overall net adjusted kWh reduction of 110 kWh per household.

Wave 4 led to savings in PY1 (January 2011-December 2012). This cohort saved an average annual net savings of 1.25% per household in PY1 resulting in an annual reduction of 67 kWh per household.

⁴⁵ The start of the program period is defined by the month in which mailings began, though the program treatment period may begin in a later month (typically a month after a participant receives their first report).

⁴⁶ Baseline usage is calculated by adjusting average daily usage in the pre-period months that were included in analysis to the number of days included in the treatment period. For OPOWER Group 2010, baseline usage is less than a full year, while Group 2011 is annualized.

⁴⁷ The confidence intervals in this evaluation, when divided by the savings estimates, provide the relative precision. However, it is important to note that the confidence bounds reflect standard errors that must be interpreted differently in this evaluation than in evaluations where we are estimating impacts based on samples. The OPOWER program participants cannot reasonably be considered a sample; each cohort is a population of program participants, and thus, standard errors, confidence intervals, and precision estimates cannot be interpreted in the usual way.

⁴⁸ For each part of Group 2010, savings apply to the treatment period, which is less than a full year. For Group 2011, the data are annualized using the data available to the evaluation team, and thus represent a full year of savings. Notably, not all programs were implemented for the full 2011 program year. In cases where the program did not start in January 2011, some of these “annual savings” occur in 2012.

- In PY1, we found statistically significant savings due to other programs in our channeling analysis.

In PY1 the channeling analysis found that 0.23% of savings are associated with the other programs for this group. The initial estimate of program savings from the LFER was 1.25% prior to looking at participation in other programs. Because the savings from participation in other programs were statistically significant, the final net savings figure is adjusted to 1.02% per household with an overall net adjusted kWh reduction of 54 kWh per household.

B. DETAILED PROGRAM DESCRIPTIONS

Below we provide tables describing each of the Massachusetts behavioral programs that have been fielded to date. These summaries include a description of the program, its design and program theory, budget, target population, outreach methods, claimed energy savings, and evaluation approaches.

Table 31. National Grid Home Energy Report Program

Description	Program Overall	
Implementer	OPOWER	
Program Theory	The program is designed to provide normative comparisons coupled with energy savings recommendations to educate and motivate participants to take energy saving actions and behaviors within their homes.	
Outreach Tactics	Home Energy Reports (direct mail) and OPOWER Social (OPOWER website, Promoted in Home Energy Report)	
Evaluation Tactics	Participant and Control experimental design enables a fixed effects regression to estimate aggregate energy savings.	
Channeling Approach	OPOWER includes a channeling assumption in savings projections.	
Reporting	Quarterly reports include number of participants and savings based on LFER modeling per cohort.	
Program Components	Electric	Gas
Total Annual budget*	2010: 1,166,038 2011: 2,561,921 2012: 3,374,377	2010: \$531,338 2011: \$2,515,032 2012: \$2,678,785
Total Savings planned in filings*	2010: 26,000 MWh 2011: 52,018 MWh 2012: 72,683 MWh	2010: 730,000 therms 2011: 2,524,600 therms 2012: 4,150,005 therms
Date of launch by Cohort	Cohorts: 2009: October 2009–present 2010: February 2010–present 2010 Add: October 2010 – present 2011: January 2011–present 2011 Add: November 2011–present 2012 Dual Fuel: December 2011 – present 2012: January 2012 – present	Cohorts: 2009: October 2009–present 2010: October 2010–present 2011: January 2011 – present 2011 Add: November 2011 – present 2012 Dual Fuel: December 2011 – present 2012: January 2012 – present
2012 Planned Savings Goals by Cohort**	Cohorts: 2009: 2.05% 2010: 1.60% 2010 Add: 2.16% 2011: 1.75% 2012 Dual Fuel: 1.38%	Cohorts: 2009: 1.46% 2010: 1.10% 2011: 1.10% 2011 Add: 0.97% 2012 Dual Fuel: 0.97%

Detailed Program Descriptions

Description	Program Overall	
	2012: 1.44%	2012: 0.97%
Total Number of participants planned***	2010: 100,000 2011: 200,000 2012: 369,000	2010: 100,000 2011: 200,000 2012: 300,000
Target participants	Residential homeowners with high energy use, SF homes, 12 months billing history. Electric pilot territory was chosen to avoid Worcester due to a planned Smart Grid pilot. For 2011, 2012 Dual Fuel and 2012 cohorts, all customers were eligible for the program. Additionally, multifamily buildings were also included in the targeting.	Residential homeowners with gas heating; single family homes. For 2011 Add, 2012 Dual Fuel and 2012 cohorts, all customers were eligible for the program. Additionally, multifamily buildings were also included in the targeting.
Metrics	Aggregate savings are tracked on a quarterly and yearly basis to provide: Resource Metrics: <ul style="list-style-type: none"> • Normalized Gross Electricity Savings (annual) • Gross Verified Electricity Savings (annual) • Gross Electricity Savings (quarterly) Non-Resource Metrics: <ul style="list-style-type: none"> • Web analytics metrics (site visits, page views, pages/visit, bounce rate, average time on site, % new visits, absolute unique visitors, average page views, technical profile, traffic sources, navigation summary) • Opt-out rates and attrition 	Aggregate savings are tracked on a quarterly and yearly basis to provide: Resource Metrics: <ul style="list-style-type: none"> • Normalized Gross Therm Savings (annual) • Gross Verified Therm Savings (annual) • Gross Therm Savings (quarterly) Non-Resource Metrics: <ul style="list-style-type: none"> • Web analytics metrics (site visits, page views, pages/visit, bounce rate, average time on site, % new visits, absolute unique visitors, average page views, technical profile, traffic sources, navigation summary) • Opt-out rates and attrition

* From 2012 Mid Term Modification 08-50 Tables, as planned for all years, costs equal Total PA Costs. The annual budget combines many cohorts together and cannot be split into cohorts.

** From the 2012 Plan TRM

***From 2012 Mid Term Modification 08-50 Tables, as planned for all years; participants are cumulative. Participants combine many cohorts together and cannot be split into cohorts.

Table 32. NGRID Home Energy Report Program Targeting

	Selection Criteria			Opt-In/Opt-out	Frequency of Reports	Outreach Type
	Baseline Usage	Residence	Other			
NGRID Electric						
OPOWER Group 2009	High Energy Users	Single Family Homes	None	Opt-Out	Bi-monthly	Paper, Email and Web
OPOWER Group 2010	High Energy Users	Single Family Homes	None	Opt-Out	Bi-monthly	Paper, Email and Web
OPOWER Group 2010 Add	High Energy Users	Single Family Homes	None	Opt-Out	Bi-monthly	Paper, Email and Web
OPOWER Group 2011	High Energy Users	Single Family Homes	None	Opt-Out	Bi-monthly or Quarterly	Paper, Email and Web
OPOWER Group 2011 Add	High Energy Users	Single Family and Multi-family Homes	None	Opt-Out	Bi-monthly	Paper, Email and Web
OPOWER Group 2012 Dual Fuel (Electric Only)	All eligible	Single Family and Multi-family Homes	None	Opt-Out	Bi-monthly	Paper, Email and Web
OPOWER Group 2012	All eligible	Single Family and Multi-family Homes	None	Opt-Out	Bi-monthly	Paper, Email and Web
NGRID Gas						
OPOWER Group 2009	None	Single Family Homes	Homeowners with gas heating	Opt-Out	Seasonal	Paper and Web
OPOWER Group 2010	None	Single Family Homes	Homeowners with gas heating	Opt-Out	Seasonal	Paper and Web
OPOWER Group 2011	None	Single Family Homes	Homeowners with gas heating	Opt-Out	Seasonal	Paper and Web
OPOWER Group 2011 Add	None	Single Family and Multi-family Homes	None	Opt-Out	Seasonal	Paper, Email and Web
OPOWER Group 2012 Dual Fuel (Gas only)	All eligible	Single Family and Multi-family Homes	None	Opt-Out	Seasonal	Paper, Email and Web
OPOWER Group 2012	All eligible	Single Family and Multi-family Homes	None	Opt-Out	Seasonal	Paper, Email and Web

Table 33. NSTAR Home Energy Report Program

Description	Program Overall	
Implementer	OPOWER	
Program Theory	The program is designed to provide normative comparisons coupled with energy savings recommendations to educate and motivate participants to take energy saving actions and behaviors within their homes.	
Outreach Tactics	Home Energy Reports (direct mail) and Energy Insider Website (Promoted in Home Energy Report)	
Evaluation Tactics	Participant and Control experimental design enables a fixed effects regression to estimate aggregate energy savings.	
Channeling Approach	OPOWER includes a channeling assumption in savings projections and actuals.	
Reporting	Quarterly reports include the number of participants, expenditures and therm savings based on planned (deemed) energy savings. 2011 reporting will include OPOWER's savings estimate.	
Program Components	Electric	Gas
Total Annual budget*	2012: \$714,662	2011: \$350,000 2012: \$316,088
Total Savings planned in filings*	2012: 168.16 MWh	2011: 366,850 therms 2012: 522,504 therms
Date of launch by Cohort	Cohorts: Wave 3: March 2012 –present Wave 4: May 2012–present	Cohorts: Wave 1: August 2010 –present Wave 2: February 2011 –present
2012 Savings Goals by Cohort**	Cohorts: Wave 3: 1.44% Wave 4: 1.44%	Cohorts: Wave 1: NA Wave 2: NA
Total Number of participants planned***	Wave 3: 60,000 Wave 4: 20,000	Wave 1: 25,000 Wave 2: 25,000
Target participants	Wave 3 targeted residential electric homeowners with high energy use. However, Wave 4 targeted only residential electric households with high energy use. Participants could be single-family or multi-family.	Residential gas customers with high energy use who are dual fuel NSTAR customers. Participants could be single-family or multi-family homeowners or renters. Targets all of NSTAR gas territory but excludes National Grid electric customers. Specific targeting was not performed for the Wave 2 participants.
Metrics	Aggregate savings are tracked on a quarterly and yearly basis to provide: Resource Metrics: <ul style="list-style-type: none"> • Normalized Gross Electricity Savings (annual) • Gross Verified Electricity Savings (annual) • Gross Electricity Savings (quarterly) Non-Resource Metrics: <ul style="list-style-type: none"> • Web analytics metrics (site visits, page views, pages/visit, bounce rate, average time on site, % 	Aggregate savings are tracked on a quarterly and yearly basis to provide: Resource Metrics: <ul style="list-style-type: none"> • Normalized Gross Therm Savings (annual) • Gross Verified Therm Savings (annual) • Gross Therm Savings (quarterly) Non-Resource Metrics: <ul style="list-style-type: none"> • Web analytics metrics (site visits, page views, pages/visit, bounce rate, average time on site, %

Description	Program Overall	
	new visits, absolute unique visitors, average page views, technical profile, traffic sources, navigation summary) • Opt-out rates and attrition	new visits, absolute unique visitors, average page views, technical profile, traffic sources, navigation summary) • Opt-out rates and attrition

* From 2012 Mid Term Modification 08-50 Tables, as planned for all years, costs equal Total PA Costs. The annual budget combines many cohorts together and cannot be split into cohorts.

** From the 2011 Plan TRM

***From 2012 Mid Term Modification 08-50 Tables, as planned for all years; participants are cumulative. Participants combine many cohorts together and cannot be split into cohorts.

Table 34. NSTAR Home Energy Report Program Targeting

	Selection Criteria			Opt-In/Opt-out	Frequency of Reports	Outreach Type
	Baseline Usage	Residence	Other			
NGRID Electric						
Wave 3	High Users	Both	Homeowners	Opt-Out	Seasonal	Paper and Web
Wave 4	High Users	Both	None	Opt-Out	Seasonal	Paper and Web
NGRID Gas						
Wave 1	High Users	Both	None	Opt-Out	Seasonal	Paper and Web
Wave 2	None	Both	None	Opt-Out	Seasonal	Paper and Web

Table 35. WMECo Western Mass Saves Pilot

Description	Program Overall		
3-year budget	\$150,000 Annual Budget, with additional budget based upon pilot success		
Savings claimed in filings	N/A		
Date of pilot launch	November, 2010		
Program Theory	<p>Western Mass Saves program is designed to generate verified energy savings. Activities are based upon four principles:</p> <ul style="list-style-type: none"> • Personalized recommendations • Goal setting and feedback • Social context and comparisons • Rewards 		
Outreach Tactics	Multi-channel behavioral marketing approach to capture all possible savings and boost program participation rates. Outreach to customers through: 1) Web portal, 2) Direct mail, and 3) Community outreach efforts. All efforts are cross marketed.		
Reporting	An outcome report will be generated for the EEAC at the end of 2011.		
Program Components	Web Portal	Mailer	Community Based Outreach
Implementer	C3	C3	Smart Power
Goals	<p>Primary component of the program. Goals include:</p> <ul style="list-style-type: none"> • 5,000 web sign-ups • 1.5% energy savings for passive customers (those who receive report, but do not go online), and 5-6% energy savings for customers who go online • Educate customers about how conservation actions lead to reductions in their bill • Have people take conservation actions 	<p>Goals include:</p> <ul style="list-style-type: none"> • Channel participants into online platform • Generate energy savings 	<p>Goals include:</p> <ul style="list-style-type: none"> • 3% aggregate energy savings • Community milestones (e.g. 5-year reduction plans in energy to receive 1 kW PV panel for municipal buildings, provide purchasing support for 20% clean energy). • Channel participants into online platform
Number of participants	7,856 customers enrolled on the web portal, with 1,275 new enrollees in 2012	25,000 participants, 25,000 control within target communities	<p>Four targeted communities, five control communities by zip code. These include:</p> <ul style="list-style-type: none"> • Springfield • West Springfield • Ludlow • Agawam • Easthampton • Amherst/Pelham • Montgomery • Sunderland
Target participants	All customers in service territory.	Randomly chosen households with	Communities targeted by demographics

Detailed Program Descriptions

		property records and available billing data.	and high energy use.
Outreach Tactics	Online web platform. Customers also receive a report via email that is automatically sent out to users. M&O also includes press releases, links on WMECo website, TV and radio interviews, challenge towns (ground engagement with environmental groups).	Direct mailers to participant households. Mailer provides links to web portal. M&O also includes press releases, links on WMECo website, TV and radio interviews, challenge towns (ground engagement with environmental groups).	Community events, grass roots social networking, competitions and incentives, earned media, field marketing. Promotion of web portal. M&O also includes press releases, links on WMECo website, TV and radio interviews, challenge towns (ground engagement with environmental groups).
Metrics	End-year-reporting will include aggregate and individual savings, such as: Resource Metrics: <ul style="list-style-type: none"> • Normalized Gross Electricity Savings • Gross Verified Electricity Savings • Gross Deemed Savings • Net Deemed Savings • Net Verified Electricity Savings Non-Resource Metrics: <ul style="list-style-type: none"> • Acquisition metrics (website hits, web sign-ups from mailer and no-mailer customers) • Activation metrics (rewards program registration, savings plan commitments) • Engagement Metrics (cross program referrals, number and most common committed actions, estimated resource savings from committed actions) 	End-year-reporting will include aggregate and individual savings, such as: Resource Metrics: <ul style="list-style-type: none"> • Normalized Gross Electricity Savings • Gross Verified Electricity Savings • Gross Deemed Savings • Net Deemed Savings • Net Verified Electricity Savings Non-Resource Metrics: <ul style="list-style-type: none"> • Mailer customer opt-outs • Engagement Metrics (cross program referral) 	End-year-reporting will include aggregate and individual savings, such as: Resource Metrics: <ul style="list-style-type: none"> • Normalized Gross Electricity Savings • Gross Verified Electricity Savings • Gross Deemed Savings • Net Deemed Savings • Net Verified Electricity Savings Non-Resource Metrics: <ul style="list-style-type: none"> • Engagement Metrics (cross program referral, number of events, number of attendees, etc.)
Channeling Approach	Tracks C3's product purchase e-commerce tracking metrics.	Compares participants/control households to list of RA participants provided by PA; uses deemed savings to calculate net savings.	Aggregates RA program uptake by zip code.
Client Reporting	Bi-weekly reporting on web metrics.	Billing analysis tracked month to month to provide aggregate "verified savings" in annual report (TBD). Planning on monthly reporting.	Follow up is required, but appears to be reporting on community based efforts including attendance at community events, meetings with environmental groups, businesses, and other key stakeholders.

C. DETAILED CHANNELING RESULTS

Table 36, Table 37, Table 38, and Table 39 show a detailed summary of cross-program participation and the savings associated with these programs.

Table 36. National Grid Participation Lift and Savings by Cohort and Program Year – Gas^a

NGRID Gas	OPOWER Group 2009 Pilot			OPOWER Group 2010		OPOWER Group 2011		OPOWER Group 2011 Add	OPOWER Group 2011 Dual Fuel*	OPOWER Group 2012
Program Year	Y1	Y2	Y3	Y1	Y2	Y1	Y2	Y1	Y1	Y1
Incremental Participation (% per HH)										
Low Income Single Family	0.00%	0.00%	-0.02%	0.00%	0.06%	0.00%	0.11%	-0.08%	0.18%	0.01%
ENERGY STAR Products	0.00%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.18%	0.00%
HVAC - Central AC	0.00%	0.00%	0.15%	0.00%	-0.02%	0.00%	0.01%	0.02%	0.01%	0.03%
Multifamily	0.00%	0.00%	0.00%	0.00%	0.06%	0.00%	0.05%	-0.22%	-0.16%	0.04%
Residential Conservation Service	0.01%	0.32%	0.67%	0.00%	1.85%	0.60%	1.12%	0.36%	0.37%	0.86%
Residential Gas Heating and Water Heating	0.00%	0.00%	0.56%	0.00%	0.16%	0.00%	-0.19%	0.37%	-0.23%	0.19%
Residential Lighting	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%
Residential Weatherization	0.14%	0.08%	0.84%	0.00%	1.48%	0.00%	0.99%	0.19%	0.29%	0.54%
Total % Participated At Least Once^b	0.00%	0.37%	1.35%	0.00%	1.94%	0.68%	1.04%	0.33%	0.30%	1.04%
Incremental Savings from Other Programs (% per HH)										
Incremental Savings Associated with All Program Participation	0.00%	0.00%	0.19%	0.00%	0.18%	0.00%	0.16%	0.00%	0.04%	0.005%

* Participation lift for the Dual fuel cohort calculated only once for both electric and gas programs

^aAll reported values are the statistically significant difference between treatment and control groups at a 90% confidence level. Missing values indicate no statistically significant difference between treatment and control groups.

^bNote that this metric measures the percentage of participants that participated at least once in another program, but this value can be less than the sum of the incremental participation of the individual programs because a participant could have participated in more than one program

Table 37. National Grid Participation Lift and Savings by Cohort and Program Year – Electric^a

NGRID Electric	OPOWER Group 2009			OPOWER Group 2010			OPOWER Group 2010 Add		OPOWER Group 2011		OPOWER Group 2011 Add	OPOWER Group 2012 Dual Fuel*	OPOWER Group 2012
Program Year	Y1	Y2	Y3	Y1	Y2	Y3	Y1	Y2	Y1	Y2	Y1	Y1	Y1
Incremental Participation (% per HH)													
Low Income Single Family	0.00%	0.00%	-0.05%	0.00%	0.00%	0.02%	0.00%	0.07%	0.00%	-0.09%	0.01%	0.18%	0.03%
ENERGY STAR Products	0.00%	0.00%	-0.02%	0.43%	0.11%	0.14%	0.28%	0.35%	0.00%	0.03%	0.04%	0.18%	0.20%
HVAC - Central AC	0.00%	0.00%	0.02%	0.00%	0.00%	-0.03%	0.00%	0.30%	0.00%	0.12%	0.05%	0.01%	-0.07%
Multifamily	0.00%	0.00%	0.03%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	-0.13%	-0.03%	-0.16%	0.07%
Residential Conservation Service	0.21%	0.08%	0.47%	0.50%	0.21%	0.12%	0.54%	0.15%	0.00%	0.13%	0.07%	0.37%	0.14%
Residential Gas Heating and Water Heating	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.23%	0.00%
Residential Lighting	0.00%	0.00%	0.05%	0.00%	0.00%	0.04%	0.00%	0.02%	0.00%	0.06%	0.01%	0.02%	0.00%
Residential Weatherization	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.29%	0.00%
Total % Participated At Least Once^b	0.00%	0.25%	0.36%	0.85%	0.26%	0.38%	0.77%	0.94%	0.00%	0.07%	0.14%	0.30%	0.34%
Incremental Savings from Other Programs (% per HH)													
Incremental Savings Associated with All Program Participation	0.00%	0.00%	0.17%	0.06%	0.10%	0.01%	0.05%	0.22%	0.00%	0.06%	0.08%	0.06%	0.05%

* Participation lift for the Dual fuel cohort calculated only once for both electric and gas programs

^a All reported values are the statistically significant difference between treatment and control groups at a 90% confidence level. Missing values indicate no statistically significant difference between treatment and control groups.

^b Note that this metric measures the percentage of participants that participated at least once in another program, but this value can be less than the sum of the incremental participation of the individual programs because a participant could have participated in more than one program

Table 38. NSTAR Participation Lift and Savings by Cohort and Program Year – Gas^a

NSTAR Gas	Wave 1			Wave 2	
Program Year	Y1^	Y1	Y2	Y1	Y2
Incremental Participation (% per HH)					
ENERGY STAR Appliances	0.00%	0.00%	0.00%	0.00%	0.00%

Detailed Channeling Results

Residential High Efficiency Heating Rebate	0.00%	0.12%	-0.14%	0.11%	0.07%
Residential High Efficiency Heating Rebate	0.00%	0.00%	-0.07%	0.00%	0.09%
ENERGY STAR HVAC	0.00%	0.00%	0.00%	0.00%	0.00%
ENERGY STAR Lighting	0.00%	0.00%	0.00%	0.00%	0.00%
Multifamily Program	-0.01%	0.00%	-0.02%	0.00%	-0.05%
Residential Conservation Service	0.25%	0.40%	0.02%	0.81%	0.16%
ENERGY STAR Thermostat Rebate	0.00%	0.00%	-0.09%	0.00%	-0.02%
Total % Participated At Least Once^b	0.30%	0.51%	-0.20%	0.97%	0.21%
Incremental Savings from Other Programs (% per HH)					
Incremental Savings Associated with All Program Participation	0.00%	0.04%	0.01%	0.03%	0.03%

^a All reported values are the statistically significant difference between treatment and control groups at a 90% confidence level. Missing values indicate no statistically significant difference between treatment and control groups.

^b Note that this metric measures the percentage of participants that participated at least once in another program, but this value can be less than the sum of the incremental participation of the individual programs because a participant could have participated in more than one program

Table 39. NSTAR Participation Lift and Savings by Cohort and Program Year – Electric^a

NSTAR Electric	Wave 3	Wave 4
Program Year	Y1	Y1
Incremental Participation (% per HH)		
ENERGY STAR Appliances	0.59%	0.17%
Residential High Efficiency Heating Rebate	0.00%	0.00%
Residential High Efficiency Heating Rebate	0.00%	0.00%
ENERGY STAR HVAC	0.01%	0.11%
ENERGY STAR Lighting	0.02%	0.03%
Multifamily Program	-0.05%	-0.09%
Residential Conservation Service	0.32%	0.38%
ENERGY STAR Thermostat Rebate	0.00%	0.00%
Total % Participated At Least Once^b	0.81%	0.59%
Incremental Savings from Other Programs (% per HH)		
Incremental Savings Associated with All Program Participation	0.24%	0.23%

^aAll reported values are the statistically significant difference between treatment and control groups at a 90% confidence level. Missing values indicate no statistically significant difference between treatment and control groups.

^bNote that this metric measures the percentage of participants that participated at least once in another program, but this value can be less than the sum of the incremental participation of the individual programs because a participant could have participated in more than one program

D. CHANNELING ANALYSIS: PROGRAM PARTICIPATION COUNTS

The tables below detail the participation lift analysis by cohorts and by program.

Table 40. NGRID Participation Lift – OPOWER Group 2009, Electric

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	0	41	0	21	-0.05%
ENERGY STAR products (ESP)	63	248	24	100	-0.02%
HVAC - Central AC (HVAC)	48	46	12	16	0.02%
Multifamily (MF)	0	47	0	16	0.03%
Residential Conservation Service (RCS)	251	288	127	68	0.47%
Residential Gas Heating and Water Heating (RGHWH)	0	0	0	0	0.00%
Residential Lighting (RL)	0	35	0	9	0.05%
Residential weatherization (RW)	0	0	0	0	0.00%
TOTAL					0.36%
Treatment Group Size	24,858				
Control Group Size	9,833				

Table 41. NGRID Participation Lift – OPOWER Group 2010, Electric

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	3	153	0	18	0.02%
ENERGY STAR products (ESP)	608	776	83	86	0.14%
HVAC - Central AC (HVAC)	96	464	13	62	-0.03%
Multifamily (MF)	0	86	0	8	0.03%
Residential Conservation Service (RCS)	1,124	1,004	2,128	117	0.12%
Residential Gas Heating and Water Heating (RGHWH)	0	0	0	0	0.00%
Residential Lighting (RL)	0	144	0	15	0.04%
Residential weatherization (RW)	0	0	0	0	0.00%
TOTAL					0.38%
Treatment Group Size	74,771				
Control Group Size	9,581				

Table 42. NGRID Participation Lift – OPOWER Group 2010 Add, Electric

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	51	11	16	-2	0.07%
ENERGY STAR products (ESP)	506	-80	165	-47	0.35%
HVAC - Central AC (HVAC)	120	82	44	2	0.30%
Multifamily (MF)	0	76	0	21	0.00%
Residential Conservation Service (RCS)	237	294	61	72	0.15%
Residential Gas Heating and Water	0	0	0	0	0.00%

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Heating (RGHWH)					
Residential Lighting (RL)	0	23	0	5	0.02%
Residential weatherization (RW)	0	0	0	0	0.00%
TOTAL					0.94%
Treatment Group Size	24,706				
Control Group Size	6,926				

Table 43. NGRID Participation Lift – OPOWER Group 2011, Electric

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	307	89	30	16	-0.09%
ENERGY STAR products (ESP)	1,970	-408	178	-39	0.03%
HVAC - Central AC (HVAC)	317	234	20	10	0.12%
Multifamily (MF)	35	471	6	54	-0.13%
Residential Conservation Service (RCS)	1,207	984	97	77	0.13%
Residential Gas Heating and Water Heating (RGHWH)	0	1	0	0	0.00%
Residential Lighting (RL)	0	138	0	7	0.06%
Residential weatherization (RW)	0	0	0	0	0.00%
TOTAL					0.07%
Treatment Group Size	100,345				
Control Group Size	9,022				

Table 44. NGRID Participation Lift – OPOWER Group 2011 Add, Electric

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	248	-23	137	-13	0.01%
ENERGY STAR products (ESP)	709	-153	356	-88	0.04%
HVAC - Central AC (HVAC)	131	-7	75	-18	0.05%
Multifamily (MF)	459	-129	215	-57	-0.03%
Residential Conservation Service (RCS)	346	656	167	307	0.07%
Residential Gas Heating and Water Heating (RGHWH)	0	0	0	0	0.00%
Residential Lighting (RL)	0	36	0	16	0.01%
Residential weatherization (RW)	0	0	0	0	0.00%
TOTAL					0.14%
Treatment Group Size	58,196				
Control Group Size	29,077				

Table 45. NGRID Participation Lift – OPOWER Group 2012 Dual Fuel, Electric and Gas

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	38	45	50	22	0.18%
ENERGY STAR products (ESP)	193	-9	201	-31	0.18%
HVAC - Central AC (HVAC)	57	-15	59	-16	0.01%

Channeling Analysis: Program Participation Counts

Multifamily (MF)	107	-54	95	-34	-0.16%
Residential Conservation Service (RCS)	92	260	91	215	0.37%
Residential Gas Heating and Water Heating (RGHWH)	114	38	112	67	-0.23%
Residential Lighting (RL)	0	18	0	15	0.02%
Residential weatherization (RW)	71	254	77	219	0.29%
TOTAL					0.30%
Treatment Group Size	12,493				
Control Group Size	12,534				

Table 46. NGRID Participation Lift – OPOWER Group 2012, Electric

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	395	30	169	4	0.03%
ENERGY STAR products (ESP)	1,121	-222	524	-171	0.20%
HVAC - Central AC (HVAC)	267	11	97	29	-0.07%
Multifamily (MF)	658	202	323	64	0.07%
Residential Conservation Service (RCS)	660	1,155	315	461	0.14%
Residential Gas Heating and Water Heating (RGHWH)	0	1	0	1	0.00%
Residential Lighting (RL)	3	96	1	41	0.00%
Residential weatherization (RW)	0	1	0	0	0.00%
TOTAL					0.34%
Treatment Group Size	83,406				
Control Group Size	36,996				

Table 47. NGRID Participation Lift – OPOWER Group 2009, Gas

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	0	17	0	10	-0.02%
ENERGY STAR products (ESP)	0	0	0	0	-0.01%
HVAC - Central AC (HVAC)	0	0	0	0	0.15%
Multifamily (MF)	0	7	0	6	0.00%
Residential Conservation Service (RCS)	0	0	0	0	0.67%
Residential Gas Heating and Water Heating (RGHWH)	1	8	1	7	0.56%
Residential Lighting (RL)	0	0	0	0	0.00%
Residential weatherization (RW)	1	8	1	9	0.84%
TOTAL					1.35%
Treatment Group Size	21,968				
Control Group Size	8,679				

Table 48. NGRID Participation Lift – OPOWER Group 2010, Gas

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	0	13	0	18	0.06%
ENERGY STAR products (ESP)	0	0	0	0	0.00%

Channeling Analysis: Program Participation Counts

HVAC - Central AC (HVAC)	0	0	0	0	-0.02%
Multifamily (MF)	0	3	0	4	0.06%
Residential Conservation Service (RCS)	0	0	0	0	1.85%
Residential Gas Heating and Water Heating (RGHWH)	1	3	2	2	0.16%
Residential Lighting (RL)	0	0	0	0	0.00%
Residential weatherization (RW)	1	7	2	7	1.48%
TOTAL					1.94%
Treatment Group Size	68,189				
Control Group Size	8,581				

Table 49. NGRID Participation Lift – OPOWER Group 2011, Gas

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	0	15	0	16	0.11%
ENERGY STAR products (ESP)	0	0	0	0	0.00%
HVAC - Central AC (HVAC)	0	0	0	0	0.01%
Multifamily (MF)	0	3	0	5	0.05%
Residential Conservation Service (RCS)	0	0	0	0	1.12%
Residential Gas Heating and Water Heating (RGHWH)	1	2	1	2	-0.19%
Residential Lighting (RL)	0	0	0	0	0.00%
Residential weatherization (RW)	1	7	1	7	0.99%
TOTAL					1.04%
Treatment Group Size	103,557				
Control Group Size	9,483				

Table 50. NGRID Participation Lift – OPOWER Group 2011 Add, Gas

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	2	8	1	9	-0.08%
ENERGY STAR products (ESP)	0	0	0	0	0.00%
HVAC - Central AC (HVAC)	0	0	0	0	0.02%
Multifamily (MF)	0	2	0	2	-0.22%
Residential Conservation Service (RCS)	0	0	0	0	0.36%
Residential Gas Heating and Water Heating (RGHWH)	1	2	1	2	0.37%
Residential Lighting (RL)	0	0	0	0	0.00%
Residential weatherization (RW)	1	4	1	5	0.19%
TOTAL					0.33%
Treatment Group Size	14,306				
Control Group Size	9,745				

Table 51. NGRID Participation Lift – OPOWER Group 2012, Gas

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Low-income single family (AMP)	2	9	1	8	0.01%

Channeling Analysis: Program Participation Counts

ENERGY STAR products (ESP)	0	0	0	0	0.00%
HVAC - Central AC (HVAC)	0	0	0	0	0.03%
Multifamily (MF)	1	2	1	1	0.04%
Residential Conservation Service (RCS)	0	0	0	0	0.86%
Residential Gas Heating and Water Heating (RGHWH)	1	3	1	3	0.19%
Residential Lighting (RL)	0	0	0	0	0.00%
Residential weatherization (RW)	1	5	1	5	0.54%
TOTAL					1.04%
Treatment Group Size	48,315				
Control Group Size	8,367				

Table 52. NSTAR Participation Lift – Wave 3, Electric

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
ENERGY STAR appliances (APP)	782	908	263	183	0.59%
ENERGY STAR HVAC (HVAC)	200	367	58	111	0.01%
ENERGY STAR lighting (LIT)	33	28	11	6	0.02%
Multifamily program (MF) - Electric	35	125	10	51	-0.05%
Residential Conservation Service (RCS) - Electric	1,500	1,272	498	357	0.32%
TOTAL					0.81%
Treatment Group Size	20,591				
Control Group Size	61,863				

Table 53. NSTAR Participation Lift – Wave 4, Electric

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
ENERGY STAR appliances (APP)	104	153	76	89	0.17%
ENERGY STAR HVAC (HVAC)	35	59	24	27	0.11%
ENERGY STAR lighting (LIT)	9	14	3	2	0.03%
Multifamily program (MF) - Electric	25	48	9	39	-0.09%
Residential Conservation Service (RCS) - Electric	245	211	210	132	0.38%
TOTAL					0.59%
Treatment Group Size	14,027				
Control Group Size	18,813				

Table 54. NSTAR Participation Lift – Wave 1, Gas

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of-Differences
Residential High Efficiency Heating Rebate (HEHE)	187	153	198	198	-0.14%
Residential High Efficiency Heating Rebate (HEHW)	97	102	88	109	-0.07%
Multifamily program (MF) - Gas	0	39	1	44	-0.02%
Residential Conservation Service (RCS) - Gas	189	691	172	670	0.02%
ENERGY STAR thermostat rebate (TSTAT)	118	110	123	138	-0.09%
TOTAL					-0.20%

Treatment Group Size	24,387
Control Group Size	24,390

Table 55. NSTAR Participation Lift – Wave 2, Gas

Program	Treatment (Pre)	Treatment (Post)	Control (Pre)	Control (Post)	Difference-of- Differences
Residential High Efficiency Heating Rebate (HEHE)	266	133	218	97	0.07%
Residential High Efficiency Heating Rebate (HEHW)	120	79	103	52	0.09%
Multifamily program (MF) - Gas	23	58	10	47	-0.05%
Residential Conservation Service (RCS) - Gas	173	487	127	346	0.16%
ENERGY STAR thermostat rebate (TSTAT)	247	116	171	70	-0.02%
TOTAL					0.21%
Treatment Group Size	19,734				
Control Group Size	24,672				

E. PLANNED VS. ACTUAL BASELINE FOR 2012 OPOWER IMPACT EVALUATIONS

The table below presents the planned vs. actual baseline for each program cohort. In some cases, the difference between actual and planned household consumption contributes to differences between actual savings and planned goals.

Table 56. Differences between Planned and Actual Annual Baseline Usage per Household

	2012 Planned Baseline*	2012 Actual Baseline	Difference
<i>National Grid Electric</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>
2009 OPOWER Group	11,518	10,824	-694
2010 OPOWER Group	12,738	12,033	-705
2010 OPOWER Group Add	15,585	15,132	-453
2011 OPOWER Group	9,916	9,765	-151
2011 OPOWER Group Add	12,000	6,028	-5,972
2012 OPOWER Group Dual Fuel	11,678	6,262	-5,416
2012 OPOWER Group	6,100	6,033	-67
<i>National Grid Gas</i>	<i>MMBTUs</i>	<i>MMBTUs</i>	<i>MMBTUs</i>
2009 OPOWER Group	137.2	115.0	-22
2010 OPOWER Group	141.4	116.9	-24
2011 OPOWER Group	102.7	85.8	-17
2011 OPOWER Group Add	135.8	62.8	-73
2012 OPOWER Group Dual Fuel	135.8	69.6	-66
2012 OPOWER Group	162.1	70.0	-92
<i>NSTAR</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>
Wave 3	11,678	13,786	2,108
Wave 4	6,100	10,768	4,668
<i>NSTAR</i>	<i>MMBTUs</i>	<i>MMBTUs</i>	<i>MMBTUs</i>
Wave 1	110.0**	111.5	1
Wave 2	105.0**	99.7	-5

* Taken from 2012 Plan TRM

** Taken from 2011 Plan TRM (no values available in the 2012 Plan TRM)

F. DETAILED IMPACT MODEL COEFFICIENTS (OPOWER HER PROGRAMS)

National Grid Electric Cohorts

The dependent variable for each regression is average daily electricity use for a bill cycle, in kWh. All standard errors are calculated on the assumption of clustering of errors on households.

Table 57. Model Results for Group 2009 Pilot

Variable	PY3	
	Coefficient	t-stat
Post	0.5831437	7.53
Treatment*Post	-0.7220914	-7.9
Constant ⁴⁹	29.72859	1456.92

Table 58. Model Results for Group 2010

Variable	PY3	
	Coefficient	t-stat
Post	0.877187	10.3
Treatment*Post	-0.7208336	-7.96
Constant	32.9573	2695.31

Table 59. Model Results for Group 2010 Add

Variable	PY2	
	Coefficient	t-stat
Post	-0.9085332	-8.34
Treatment*Post	-0.7794062	-6.3
Constant	41.40497	1980.68

Table 60. Model Results for Group 2011

Variable	PY2	
	Coefficient	t-stat
Post	-0.6038137	-8.49

⁴⁹ Constants shown in the following tables are the averages of individual intercepts (fixed effects).

Treatment*Post	-0.6629303	-8.94
Constant	26.72194	2484.31

Table 61. Model Results for Group 2011 Add

Variable	PY1	
	Coefficient	t-stat
Post	0.1178051	4.9
Treatment*Post	-0.2029068	-6.94
Constant	16.57379	2366.15

Table 62. Model Results for Group 2012 Dual Fuel (Electric Only)

Variable	PY1	
	Coefficient	t-stat
Post	0.0723994	2.37
Treatment*Post	-0.1626845	-3.73
Constant	17.09796	1552.1

Table 63. Model Results for Group 2012

Variable	PY1	
	Coefficient	t-stat
Post	0.0817366	4.25
Treatment*Post	-0.1714895	-7.19
Constant	16.58113	2926.21

National Grid Gas Cohorts

The dependent variable for each regression is average daily gas use for a bill cycle, in therms. All standard errors are calculated on the assumption of clustering of errors on households.

Table 64. Model Results for Group 2009 Pilot

Variable	PY3	
	Coefficient	t-stat
Post	-0.5929	-42.823
Treatment*Post	-0.0533	-3.255
Constant	3.8889	

Table 65. Model Results for Group 2010

Variable	PY2	
	Coefficient	t-stat
Post	-0.5394	-33.125
Treatment*Post	-0.0585	-3.419
Constant	3.5053	

Table 66. Model Results for Group 2011

Variable	PY2	
	Coefficient	t-stat
Post	-0.5439	-38.288
Treatment*Post	-0.0288	-1.976
Constant	2.695	

Table 67. Model Results for Group 2011 Add

Variable	PY2	
	Coefficient	t-stat
Post	-0.4500	-27.031
Treatment*Post	-0.0096	-0.881
Constant	2.3400	

Table 68. Model Results for Group 2012 Dual Fuel (Gas Only)

Variable	PY2	
	Coefficient	t-stat
Post	-0.3620	-46.942
Treatment*Post	-0.0101	-0.926
Constant	2.2035	

Table 69. Model Results for Group 2012

Variable	PY2	
	Coefficient	t-stat
Post	0.2365	37.519
Treatment*Post	-0.0272	-3.991
Constant	2.1536	

NSTAR Electric Cohorts

The dependent variable for each regression is average daily electricity use for a bill cycle, in kWh. All standard errors are calculated on the assumption of clustering of errors on households.

Table 70. Model Results for Wave 3

Variable	PY1	
	Coefficient	t-stat
Post	0.0441039	1.1
Treatment*Post	-0.4989482	-10.87
Constant	37.8318	3852.18

Table 71. Model Results for Wave 4

Variable	PY1	
	Coefficient	t-stat
Post	0.8813315	18.58
Treatment*Post	-0.3806752	-6.04
Constant	29.45509	1878.61

NSTAR Gas Cohorts

The dependent variable for each regression is average daily gas use for a bill cycle, in therms. All standard errors are calculated on the assumption of clustering of errors on households.

Table 72. Model Results for Wave 1

Variable	PY2	
	Coefficient	t-stat
Post	-0.29765	-102.32
Treatment*Post	-0.02637	-6.47
Constant	3.066245	3018.16

Table 73. Model Results for Wave 2

Variable	PY2	
	Coefficient	t-stat
Post	-0.2297642	-64.48
Treatment*Post	-0.0387105	-7.99
Constant	2.728204	2263.32

G. DETAILED IMPACT MODEL COEFFICIENTS (WMECo C3 WMS PROGRAM)

Regression Results

Table 74. LFER Model Used to Estimate 2012 Program Savings, Initial Wave

Parameter	Estimate	Standard Error	Denominator DF	t Value	Pr > t
Post	-0.7788	0.0372	45041	-20.94	<.0001
Post x Treatment	-0.2343	0.0529	45041	-4.43	<.0001

Table 75. LFER Model Used to Estimate 2012 Program Savings, Expansion Wave

Parameter	Estimate	Standard Error	Denominator DF	t Value	Pr > t
Post	0.0095	0.0325	108839	0.29	0.7714
Post x Treatment	-0.0084	0.0378	108839	-0.22	0.8236

Table 76. Bias Correction Regression for Matching Model

Variable	Parameter Estimate	Standard Error	t Value	Pr > t
Jan	3.9841	0.0985	40.44	<.0001
Feb	3.0087	0.0988	30.45	<.0001
March	2.9872	0.1003	29.77	<.0001
April	2.2652	0.0944	24.01	<.0001
May	3.3208	0.0910	36.51	<.0001
June	3.6787	0.0967	38.05	<.0001
July	6.1493	0.1098	56.01	<.0001
Aug	6.5566	0.1018	64.4	<.0001
Sept	3.2796	0.0963	34.05	<.0001
Oct	3.1619	0.0877	36.04	<.0001
Nov	4.0842	0.0930	43.93	<.0001
Dec	4.5274	0.1074	42.17	<.0001
PREkwh	0.8099	0.0016	494.61	<.0001

H. CLC FEEDBACK PROGRAM LITERATURE REVIEW

This section details the findings from Opinion Dynamics' literature review of enhanced energy feedback programs and their respective tools (in-home displays, online portals, etc) and tactics (opt-in vs. opt out, targeting, messaging, etc.).

Key Findings and Recommendations

Our review of feedback programs demonstrates that the following tools and tactics can improve energy savings per household. The table below summarizes the tactics that we recommend for the design of opt-in feedback programs, similar to those currently implemented by CLC. We rank recommended tools and tactics by per-household program savings.

Table 77. Key Components for Successful Program Design

Component	Description	Program Savings Per Household
Real-time direct feedback	Energy usage feedback provided in intervals of one-minute or less	Up to 12%
Customer targeting	Program intervention targeted to specific customers (i.e. high usage customers and customers identified through segmentation)	Up to 12%
Bill estimates or to-date spending	Information provided to customers includes real-time cost or estimated bill information	Up to 12%
Multiple customer touchpoints	Customers engage with personal savings plans, social engagement, competitions, comparisons, tips, email notifications and messaging	Up to 9.3%
Online social engagement or rewards-based engagement	Social and reward-based elements, such as challenges, direct rewards, or benchmarks, provided to customers	Up to 9.3%
Personal savings plans	Customized upfront feedback includes online audits and benchmarking or goal setting	Up to 9.3%

Introduction and Methodology

We undertook this literature review in September 2012 to provide Cape Light Compact with a high-level view of the current landscape of enhanced feedback programs, specifically the varying energy impacts of different **tools and tactics** of in-home feedback.

- **Tactics.** Customer outreach tactics include how customers are selected to participate in the program (i.e., opt-in versus opt-out deployment), as well as customer targeting and segmentation.
- **Tools.** Customer outreach tools include the delivery mechanisms in which customers interact with the program as well as the feedback content in which information is provided to achieve the greatest impact on customers' behavior. The mechanisms in which customers engage with the programs include frequency of information provided to customers (i.e., real-time feedback to weekly updates) as well as mail, email, online portals, and in-home displays. The

feedback methods in which information is provided include personal savings plans, social engagement, competitions and comparisons, energy savings tips, and program channeling.

This memo details findings from 21 in-home display (IHD) and enhanced feedback programs⁵⁰ conducted in the United States from 2004 to 2012. Note that this is not a comprehensive list of all programs that have existed,⁵¹ nor even all programs that have been implemented since 2004; instead, these programs have been chosen to reflect the variety of implementation strategies, research methodologies, and resulting savings for the different types of feedback provided through these programs.

Types of Feedback Programs

We define feedback programs (like those currently implemented by Cape Light Compact) using a framework for feedback programs as used in the American Council for an Energy-Efficient Economy (ACEEE) white paper “Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities,”⁵² published in 2010. This comprehensive meta-review looked at past feedback programs to identify the feedback program characteristics that were most likely to lead to energy savings. This framework has been used in multiple protocols to date, and as such we adopted it to remain consistent with industry trends.

In-home display and enhanced feedback programs provide customers with information about their energy usage more frequently than what already occurs through monthly utility bills. The term “feedback” itself is a catchall, with multiple types of programs that are included. There are two key types of enhanced feedback: direct feedback and indirect feedback. Our literature review includes 12 direct feedback programs, 9 indirect feedback programs, and one program that tested both direct and indirect feedback treatments. Detailed write-ups for these programs are available in the Appendix.

In this report, we define **direct feedback** as programs that use specialized devices to provide customers with information about their energy use in real time or near real time (no more than 15-minute delay).

Indirect feedback refers to programs that provide customers with information about their energy use after the usage has occurred. Indirect feedback programs often include website integration, including Online Dashboards that detail billing usage over the course of the customer’s billing period, and Online Audits that allow customers to identify the key energy-using equipment they have installed in their homes.

We provide more detailed definitions of these terms in the Appendix.

⁵⁰ “Enhanced feedback” refers to the broad umbrella of behavioral programs that provide customers with additional details about their usage beyond the information included in their monthly bills.

⁵¹ Additional reviewed programs that are not described in depth in the literature review are provided in the “Further Reading” section at the end of this document. Feedback studies have been conducted since the 1960s and span three continents but were excluded in the interests of providing the most current, locally relevant program information.

⁵² Ehrhardt-Martinez, Karen, Kat A. Donnelly and John A. “Skip” Laitner. Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities. Washington: American Council for an Energy-Efficient Economy, 2010. 2012.

Detailed Findings

Program Tools and Tactics Overview

The types of feedback programs vary enormously and have changed significantly over time. We also examined the programs' specific tools and tactics, and looked across programs to see which tools and tactics relate to savings. Table 78 below presents the tools and tactics.

Table 78. Matrix of Tools and Tactics by Program (Ranked Highest to Lowest Savings)

Program	Mean Savings Per Household	Participant Population Size	Total Savings (Annual)	Tactics								Tools									
				Opt-in	Real-Time Usage Updates (<1 min)	Near-Real-Time Usage Updates (15 min)	Daily to Weekly Usage Updates	Targets Specific Customers	Sample Sub-Groups	Change in Rate	Demand Response	Mail	Email/Text Message	Online Portal	In-Home Display	Cost (Predicted Bill or RTC)	Personal Savings Plan ^a	Social Engagement	Competition/Comparison	Tips	Program Channeling
High Savings																					
Salt River Projects M-Power Program (2005-2006)	12%	272	NC	X	X			X		X					X	X					
Cape Light Compact In-Home Display Pilot (ICES 2009-2012)	11.7%	80	NC	X	X			X			X		X	X		X	X	X	X	X	X
Hydro One PowerCost Monitor Pilot (2004-2005)	~8.5% ^c	500	NC	?	X				X						X	X					
Research Institute of Central Florida In-Home Display Pilot (2005-2007)	7.40%	17	22.2 MWh	X	X										X						
Illinois Citizens Utility Board Energy Saver Program (2010-2011)	~5.3% ^c	2,925	1890 MWh	f			X	X	X			X	X	X			X	X		X	X
Moderate Savings																					
Payson City Power Energy Efficiency Reports (2010-2011)	2.40%	5,000	726 MWh	f			X		X			X	X	X			X	X	X	X	
WMECo C3 Western Mass Saves! Program (2010-2011)	~2.5% ^c	24,617	1740 MWh ^e	f			X		X			X	X	X			X	X	X	X	X
Cape Light Compact Smart Home Energy Monitoring Pilot (2011-2012) ^b	2.30%	277	NC	X		X								X	X	X	X		X		X
Massachusetts PowerCost Monitor Pilot (2007)	1.90%	3,512	790 MWh	X	X										X	X					

Program	Mean Savings Per Household	Participant Population Size	Total Savings (Annual)	Tactics								Tools									
				Opt-in	Real-Time Usage Updates (<1 min)	Near-Real-Time Usage Updates (15 min)	Daily to Weekly Usage Updates	Targets Specific Customers	Sample Sub-Groups	Change in Rate	Demand Response	Mail	Email/Text Message	Online Portal	In-Home Display	Cost (Predicted Bill or RTC)	Personal Savings Plan ^a	Social Engagement	Competition/Comparison	Tips	Program Channeling
Wisconsin Focus on Energy PowerCost Monitor Study (2008-2009)	1.50%	218	27.5 MWh	X	X										X	X				X	
Pennsylvania Power & Light Aclara Program (2008-2009)	~1.5% ^c	9,739	50.0 MWh	X			X		X	^g			X	X		X	X			X	X
California Critical Peak Pricing Pilot (2005)	0.061 kW ^d	152	9.3 kW ^d	X			X	X			X		X	X							
SCE&G My Home Energy Report Program (2011-2012)	327 kWh	26,901	8800 MWh	^f			X		X			X	X	X			X	X	X	X	X
BC Hydro Team Power Save Program (2008-Present)	208 kWh	25,000	5200 MWh	X			X	X					X	X			X	X		X	
SCE&G In-Home Display Pilot Phase 2 (2011-2012)	64.2 kWh	3,117	200 MWh	X		X							X	X	X	X				X	X
Low/No Savings																					
Stanford/Google In-Home Display Web App Pilot (2011)	0%	1,065	0 kWh		X									X	X	X					
Commonwealth Edison Customer Applications Program (2010-2011)	0%	7,825	0 kWh			X	X		X	X	X	X	X	X	X	X		X	X		
Arizona Public Service Aclara Program (2008-2009)	0%	36,905	0 kWh	X					X				X	X		X	X			X	
Energy Trust of Oregon PowerCost Monitor Pilot (2008)	0%	200	0 kWh	X	X					^g					X	X					
Not Calculated																					

Program	Mean Savings Per Household	Participant Population Size	Total Savings (Annual)	Tactics								Tools									
				Opt-in	Real-Time Usage Updates (<1 min)	Near-Real-Time Usage Updates (15 min)	Daily to Weekly Usage Updates	Targets Specific Customers	Sample Sub-Groups	Change in Rate	Demand Response	Mail	Email/Text Message	Online Portal	In-Home Display	Cost (Predicted Bill or RTC)	Personal Savings Plan ^a	Social Engagement	Competition/Comparison	Tips	Program Channeling
San Diego Gas & Electric Home Area Network Pilot (2011)	NC	552	NC	X		X		X	X		X		X	X	X		X	X	X		
South Carolina Electric & Gas In-Home Display Pilot Phase 1 (2010-2011)	NC	245	NC	X		X		X						X	X	X				X	X
BC Hydro Team Power Save Pilot (2007-2008)	NC	NC	NC	X			X						X	X			X	X		X	

NC= Not calculated

^a This includes online audits and benchmarking/goal-setting).

^b Phase 2 (“Energize”) participants only. Phase 1 (“Legacy”) design and participation are accounted for in the “Cape Light Compact In-Home Display Pilot (2009-2010)” entry.

^c For these programs, a range of mean savings were provided (for example, for the Hydro One study the mean per-person savings were estimated at “7 to 10%”), or savings were provided only for mutually exclusive groups (e.g. savings for 3 levels of Aclara participation). The values in this table are the mean values of the ranges provided.

^d Savings for demand response events only.

^e Note that this excludes customers who received reports and opted in to the website (n=668) as kWh savings could not be precisely calculated for this subgroup.

^f Participants receive home energy reports that are opt-out; they may also use the program online interface, which is opt-in.

^g Utilities rolled out these programs in advance of an overall rate increase.

Tools and Tactics of High Energy Saving Programs

Below, we outline the best practices observed among those programs with the greatest energy savings per household.

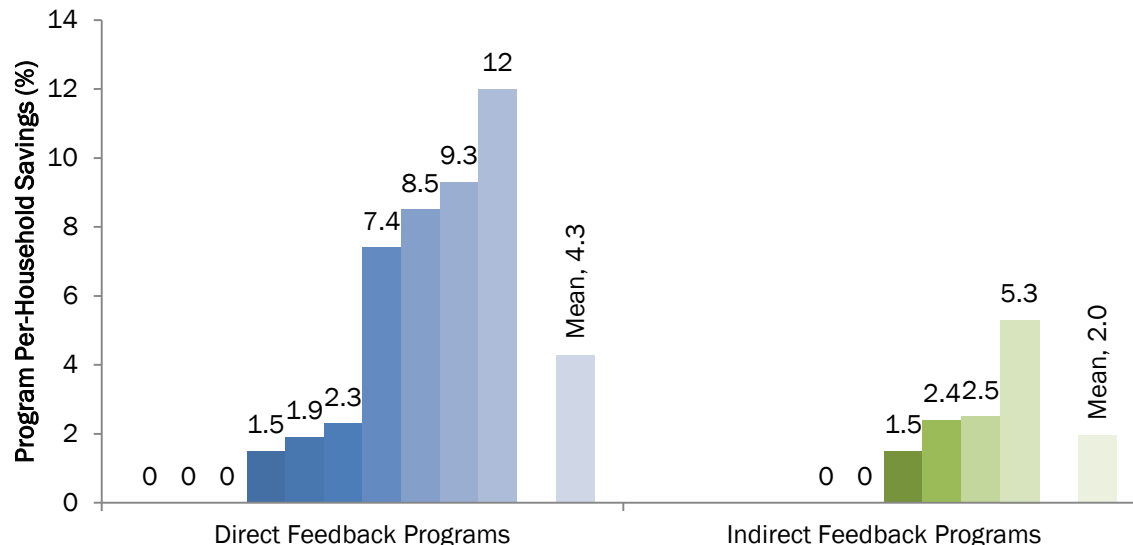
Tactics to Promote Customer Engagement

- **Most programs are opt-in or have opt-in elements.** For IHD programs, this is especially important as there are some customers who will never be interested in the device, and a general-population, opt-out approach is unlikely to be cost-effective or gain significant savings per household. Indirect feedback programs reach wider audiences with opt-out reports, but get higher per-household savings when they also offer opt-in elements.

Direct vs. Indirect Feedback

- **Direct and indirect feedback program models offer potential for high savings per household, but higher overall savings per household with real-time feedback.** This is consistent with earlier reviews of feedback programs. Figure 51 shows the comparison of direct and indirect feedback programs that estimated savings per household (as a percentage per household). Direct feedback programs, particularly those that show data in 1-minute intervals or less, prompted higher per household savings, with a mean of 4.3% savings, compared with a mean of 2.0% for indirect programs. However, as we discuss below, there are segments within these populations where savings were much higher than for the rest of the population.

Figure 51. Estimated Per-Household Savings by Feedback Type (n=15)*



*Note that this figure excludes programs that did not provide per-household average savings, including one direct feedback program and three indirect feedback programs that provided savings estimates in kWh or kW only. One program, which had both direct and indirect feedback elements, is counted under both categories.

This figure also excludes three programs where savings were not calculated.

Participant Targeting

- **Programs with the highest savings per household tend to target specific groups of customers for participation.** Programs without customer segmentation or targeting were more likely to have moderate to no savings per household overall.
- **Tactics of customer targeting used in past studies include high-usage customers and customers identified through segmentation** to be interested in saving energy but have not taken action.
- **Notably, all of the programs that produced zero savings per household had no customer targeting.** This includes a ComEd study, which comprised several customer outreach and engagement efforts (for selected treatment sub-groups), but did not explore customer segmentation or specifically identify customers who were most likely to save.

Table 79 lists programs that conducted targeted customer recruitment, along with their associated savings where available.⁵³

Table 79. Types of Customer Targeting

Program Name	Targeting Description	Per-Household Savings
Salt River Project M-Power Program (Direct Feedback)	Targets customers who signed up for Salt River Project pre-paid billing plan (i.e., customers who would be likely to sign up for pre-paid billing such as customers in arrears on their SRP bills.	High (12%)
Cape Light Compact Tendril In-Home Display Pilot (Direct)	Geographic targeting of high-usage households (650 kWh/month or more).	High (9.3%)
BC Hydro Team Power Smart (Indirect)	Targets customers who are identified as “stumbling proponents”: customers who have positive attitudes toward saving energy but take few actions to save. This group is estimated to be about 20% of the population.	Moderate (208 kWh per-household)
SDG&E Tendril In-Home Display Pilot (Direct)	Targeted high-usage households (700 kWh/mo or more). The programmable communicating thermostat (PCT) and IHD pilots targeted low-income customers specifically.	Not calculated (as of Sept. 2012)

- **Some past programs have also identified the highest savers through a subdivided treatment group.** These studies include general population treatment groups but identify subgroups that may have higher savings than the rest of the treatment group. Stratifications in past studies have included energy usage (high, medium, low) or equipment fuel (electric or gas). These programs have identified different savings levels based on these subgroups, as shown in Table 80. These customers, while not specifically targeted during these studies, may also serve as target groups for recruitment.

⁵³ Three pilots are marked as “Targets Specific Customers” in Table 13 but are not included in this table; two of these pilots targeted within each utility’s existing customer panels, while one targeted customers within a certain rate type. Thus, the programs target specific customers within their customer base, but as customer panels they cannot be considered a “target group” within the general population.

Table 80. Treatment Group Subdivision Savings⁵⁴

Program Name	Sample Subdivision Description	Overall Per-Household Savings	Sub-Group Per-Household Savings
Commonwealth Edison Customer Applications Program (2010-2011)	Subgroup within IHD/Critical peak pricing treatment group (about 10%), not otherwise defined.	None (0%)	High (20% during demand response events and 14% during other peak times)
Hydro One PowerCost Monitor Pilot (2004-2005)	Space heating fuel type (non-electric).	High per-person (8.5%) and aggregate (6.5%)	High (aggregate 8.2%)
Arizona Public Service Aclara Program (2008-2009)	Pre-program usage (top one-third of energy users).	None (0%)	High (6.3%)
Wisconsin Focus on Energy PowerCost Monitor Study (2008-2009)	Pre-program usage (top three-fourths of energy users).	Moderate (1.5%)	Moderate (3.4%)

Rate Changes and Demand Response Integration

- **Rate changes and demand response integration may not be key to program success.** Few programs integrated changes in billing rate or demand response elements into their program designs. Past reviews of feedback technology have noted that too much focus on demand response can also be detrimental in programs with overall savings goals, as customers tend to shift demand to other times of day rather than reduce their usage overall.⁵⁵

Tools to Promote Customer Engagement

Delivery Mechanisms

- The highest per household savings tend to be achieved through programs that provide multiple, ongoing touchpoints with customers (especially through website engagement), rather than through feedback alone.
- Programs with participants who opted-in to more intensive participation, typically a subset of all report recipients, often had significantly higher savings than customers who received reports only. This is especially noticeable for indirect feedback programs, where customers may receive monthly reports or opt-in to the program website.
- **High-saving programs often include social and reward-based elements, such as challenges, direct rewards, or benchmarks.** Programs that leverage motivational tactics to keep customers engaged with the *platform* achieve greater per-household savings.
- **Most programs that generate high per-household savings include some online, interactive component.** As these programs rely on modern, increasingly sophisticated technology, online dashboards and interfaces are necessary to customer engagement.

⁵⁴ This excludes programs that subdivide the sample by level of treatment received (i.e., by level of engagement); we discuss these programs in the next section.

⁵⁵ Ehrhardt-Martinez et al.

- **As customers become more accustomed to instant information, program administrators need to compensate by providing more “push” to customers.**
 - Most studies with higher savings among “engaged” customers include program administrator “pushes” to increase engagement, such as email notifications or reminders printed on bills. Among newer programs, Program Administrator (PA) pushes are especially prevalent when producing higher savings.
 - However, we have found that these PA pushes are not enough on their own. The highest savings programs include both PA pushes and target customers who are the most interested in the information.
- **In-home displays are often included in the high-energy savings groups; however, this is not a determinant of savings.** While in-home displays are often a component of high-saving programs, they are also prevalent in low to moderate saving programs.

Note: Three of the five studies that found the highest savings were conducted more than five years ago (in 2004 and 2005). These programs offer participants instant information and little else, but still resulted in significant per-household savings. One key technology change that has occurred since these studies is the introduction of the iPhone and other smart phones, resulting in a technology culture where instant information is now a given rather than a novelty. The two high-savings programs that have been introduced in the last three years (since 2009) include significantly more participant engagement efforts from the program administrators.

Feedback Content

- **Direct feedback programs that provide to-date or estimated energy costs save more.** Nearly all of the higher saving (and direct feedback) programs include either real-time cost or estimated bill information; however, only a few of the lower-saving, indirect feedback programs mentioned that they provided this information.

Note that indirect feedback programs instead are more likely to include personal savings plans (such as online audits or benchmarking) as part of their tools for engagement, which appear to be less successful in prompting action.

- **Customized information is an important component for prompting action.** Most programs with highly engaged savers included opportunities for users to develop customized analysis and savings plans based on their home’s equipment.

Table 81. Savings Variations and Engagement Tools

Program Type	Customer Actions		Program Administrator "Pushes"				Overall Savings Per Household	Per Household Savings Among Highly Engaged
	Personal Savings Plans ^a	Social Engagement ^b	Email, text message, or mail	Competitions/ Comparisons to others	Tips	Program Channeling		
Cape Light Compact In-Home Display Pilot (2009-2010)	X	X	X	X	X	X	9.3%	NC, but highest savers checked information more often
Illinois Citizens Utility Board Energy Saver Program (2010-2011)	X	X	X		X	X	5%-5.6%	6.01% (website users)
WMECo C3 Western Mass Saves! Program (2010-2011)	X	X	X	X	X	X	2%-3%	5.5%-5.7% (website users)
Massachusetts PowerCost Monitor Pilot (2007)							1.9%	2.9% (those who said they used the device)
Wisconsin Focus on Energy PowerCost Monitor Study (2008-2009)					X		1.5%	5.4% (those who said device was useful)
Pennsylvania Power & Light Aclara Program (2008-2009)	X		X		X	X	Estimated 1%-2%	2.9% (Greatest level of engagement with audit (Level 3 participants)
BC Hydro Team Power Save Program (2008-Present)	X	X	X		X		208 kWh	NC, but "strong correlation" between engagement with information and overall savings
Arizona Public Service Aclara Program (2008-2009)	X		X		X		0%	High savings among high-usage, most engaged participants (Level 3 participants reduced 357 to 1461 kWh annually)

^a Includes online audits and personal benchmarking/goal setting.

^b Includes social networking and events.

Conclusions

The literature review indicates that incorporating the following tools and tactics into enhanced feedback program design may increase per household energy savings:

- **Provide real-time direct feedback.** Our review indicates that providing energy usage feedback in intervals of one-minute or less tend to have higher per-household energy savings than less frequent feedback.
- **Target customers.** Program interventions that target specific customers tend to have higher per-household energy savings. In cases where general population customers are recruited, high per-household savings generally derive from a sub-group of the target customers.
- **Provide bill estimates or to-date spending.**
- **Engage customers through multiple touchpoints.** A review of the literature indicates that how you interact with the customer is important, and high-savings programs tend to combine many aspects. Notably, the specific delivery mechanism does not appear to directly impact the overall savings of a given program. However, those programs with multiple touchpoints generated the greatest overall savings. Programs should consider engaging customers by:
 - **Offer personal savings plans.** Customized upfront feedback that includes goal setting, benchmarking, and online audits tend to result in higher per-household savings
 - **Provide customers with social engagement and competition through online interfaces.** This is particularly the case for programs with online interfaces. Websites are important, but awareness of the website can be an issue for some programs, especially for those with IHDs that are separate from the online dashboard.

Additional Details for the Literature review

Key Terms

- **Enhanced feedback:** A type of energy conservation behavioral program that provides customers with additional details about their usage beyond the information in their monthly bills. This includes both direct and indirect feedback. The intention of these programs is for customers to react to this information by taking immediate action to reduce energy use.
- **Direct feedback:** Programs that provide customers with information about their energy use in real-time or near-real-time (no more than 15-minute delay). Customers are able to react immediately to the information. Direct feedback programs nearly always require a home to have a smart meter and for the resident to install a separate device and connect it to that meter. These devices currently include the following:

In-Home Display (IHD): A specially installed device that provides the resident with their current usage information. IHDs will always display current usage, but may display additional information such as historical usage and associated cost for current usage. These devices can also be called an *Energy Information Display (EID)*.

Home Area Network (HAN): These devices have the same information display capabilities as an IHD, but are also connected to equipment throughout the house (such as the thermostat) to allow the resident to directly control their equipment in reaction to the device information. Home area networks usually require the installation of additional accessories to an IHD.

- **Indirect feedback:** Programs that provide customers with information about their energy use after the usage has occurred. This can range from up to one day after the usage has occurred to one month, when the customer receives their regular bill. Indirect feedback programs provide customers with additional analysis of their bills or allow customers to engage with their billing information with a greater amount of detail. However, they rarely require that customers purchase or install any new equipment. Indirect feedback programs include the following:

Online dashboards: Customers may access an online interface linked to their bill that provides them with detailed billing usage over the course of their billing period. Rather than being real-time, the information is usually updated a few days after the usage has occurred. This may include customer progress toward energy savings goals set by the customer at the beginning of their program participation; it may also include normative comparisons to neighbors' usage, or to the customer's usage during previous billing cycles. The energy report programs included in this literature review offer further analysis via online dashboards, where participating customers may review and analyze their energy usage on a daily basis.⁵⁶

Online audits: An online dashboard where the customer identifies the key energy using equipment they have installed in their home. In utility programs, this is generally linked

⁵⁶ This report, therefore, excludes OPOWER programs, which provide customers with energy reports, but only on a monthly basis and with no online dashboard component.

directly to the customers' billing information so that they may see how each home equipment type has contributed to their past energy usage over the past year or month.

Detailed Program Descriptions

Although energy feedback studies go back decades,⁵⁷ they have grown rapidly in the last few years, and the technology associated with these programs has been rapidly evolving. Utilities have begun adding feedback programs to their portfolios in only the last few years. Many earlier studies

These programs are generally intended to promote energy saving behaviors. As more utilities have brought behavioral programs into their portfolios, these programs are meant to guide customers to the most efficient actions by showing them the details of when and where they use the most energy in their homes.

However, just as energy saving behaviors themselves vary widely, programs vary significantly in implementation, research methods, and savings results. In the following sections, we describe the key programs reviewed by direct and indirect feedback programs.

⁵⁷ See Ehrhardt-Martinez et al.

Direct Feedback Programs Reviewed

Table 82. Summary of Reviewed Direct Feedback Programs (Highest to Lowest Energy Savings)

Device Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
High Savings							
Landis+ Gyr ecoMeter	Phoenix, AZ area (Salt River Project)	October 2005-October 2006 (1 year)	IHD was a component of the SRP pre-paid utility billing program. Customers signed up for a prepaid bill program and received the device as part of their participation. An estimated 30,000 customers participated during the study period.	Estimated annual per-household kWh reduction of 12% compared with customers on the standard (not pre-paid) rate	Opt-in program. Targeted general population of customers; participants need an AMI meter, which can be installed during program participation. Note that this program included a larger number of lower-income participants compared with other programs, as many participants signed up for the M-Power program due to being in arrears on the SRP bills.	Information Displays	Updated information on real-time basis (every 3 seconds); limits set on monthly usage through prepaid billing; cumulative usage information
iCES platform	Cape Cod, Massachusetts (Cape Light Compact)	Spring 2009-February 2010 (9 mos.)	IHD pilot where 91 recruited households signed up to receive a device that at no cost that connects to both their meter and their home computer. Information is displayed in real time on a computer "dashboard." The device was installed only by a professional.	Estimated daily per-household kWh reduction of 9.3% compared with control group who participated in no other CLC programs. Evaluation also found that customers with high savings interacted with the website more frequently than customers with low/no savings	Opt-in based on recruitment of qualifying households. Targeted customers with greater than 650 kWh/month usage in Cape Cod and Martha's Vineyard.	Online Interface	Monitor household usage on a near real-time basis (every 15 minutes) and sends information (via a router) to a connected dashboard device. Dashboard provides detailed usage info, including: Savings information (kWh, dollars, and CO2), Monthly usage and totals, energy savings tips, households energy use distribution, normative comparisons, and alerts to DR events (though none were called during the study period)

Device Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
The Energy Detective (TED)	Florida (Research Institute of Central FL)	Sept. 2005-Aug. 2007 (2 years)	Pilot program. Provided IHD devices to 17 homes at no cost. These devices provided real-time feedback on energy use to encourage savings.	Estimated 2-year per-household kWh reduction of 7.4% compared with control group (ranged from -9.5% to 17.5%), and weather adjusted kWh/day savings of -2.9 to 19.5 kWh. However median savings was much lower, closer to 2%, due to small sample size. The study notes that customers with the highest consumption also had the largest savings.	Opt-in. Did not target specific participants.	Information Displays	Instantaneous usage (updates every few seconds); historical usage; cumulative cost per hour; times of peak daily and monthly demand. No additional messaging other than device display.
PowerCost Monitor	Ontario, Canada (Hydro One)	Summer 2004-Sept. 2005 (1.5 years)	Pilot program. 500 customers signed up to receive the PCM feedback device from Hydro One.	Estimated 1.5-year aggregate kWh reduction of 6.5%, with average savings per person between 7% and 10%. Savings also varied by types of measures in home: customers with non-electric space heating saved aggregate 8.2% kWh, versus 1.2% for those with electric space heat. Among those with non-electric space heat, those with electric water heaters saved 16.7%, while those with non-electric water heat saved 5.1%	Possible customer panel; General population, stratified in to 6 groups based on annual kWh usage, designed to be representative of all major regions in Hydro One territory; may have been drawn from customer panel	Information Displays	Instant usage (updates approximately every 30 seconds); total cost per hour; predicted bill; historical usage (up to one month); predicted usage. No additional messaging other than device display.
Moderate Savings							

Device Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
Tendril	Cape Cod, Massachusetts (Cape Light Compact)	June-Nov. 2011 (5 mos.)	Second pilot for CLC customers. Customers received a Tendril IHD device that displayed usage at up to 15-minute intervals	Estimated daily per-household kWh of 2.3% compared with the control group	General population	Information Displays	Real-time information through device (kWh) provided every 15 minutes; historical usage; cumulative cost; “push” notification from CLC notifying of events; website provides benchmarking and normative comparisons with other homes
PowerCost Monitor	Massachusetts (NGRID, NSTAR, WMECo)	May 2007-Nov. 2007 (6 mos.)	Program tested PCM marketing and rollout methods. Customers could receive PCM device either for free from a home energy audit or by purchasing directly at one of three different price points (\$9.99, \$49.99, or \$29.99). NGRID had 377 total participants, WMECo had 32, and NSTAR had 3,103.	Estimated daily per-household kWh reduction of 1.9% compared with the control group; savings estimated to be 2.9% among those with a working device	Opt-in. Pilot program, screened for customers with compatible meters. Targeted customers slightly differently in each utility territory. NSTAR recruited general public, who paid for device, WMECo targeted home energy audit participants, and National Grid targeted both.	Information Displays	Instant usage (updates approximately every 30 seconds; total cost per hour; predicted bill; historical usage (up to one month); predicted usage
PowerCost Monitor	Madison, WI (Energy Center of WI)	Spring 2008-Summer 2009 (1 year)	300 customers signed up to receive an in-home energy information display device. These customers were randomly assigned to treatment and control groups. Treatment customers (218) received device with tip sheet, control customers (95) did not receive anything.	Estimated daily per-household kWh reduction of 1.5% compared with control group, likely within range of -1.4 to 4.3%. The study found 3.4% per-person savings among customers with functional devices, and 3.8% savings among those who check device frequently	Opt-in. Random selection of customers who expressed interest in in-home feedback display	Information Displays; Enhanced Billing Information	Instant usage (updates approximately every 30 seconds); total cost per hour; predicted bill; historical usage (up to one month); predicted usage; three non-specialized tip sheets from administrators on ways to save and available programs.

Device Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
EnergyHub	South Carolina (South Carolina Electric & Gas)	October 2011-July 2012 (1 year)	Phase 2 of 2. Residential customer program rollout, with a total of 3,117 participants. Customers called SCE&G to receive feedback device. Customers can also register for EnergyHub website to get more detailed and visualized usage information, or SCE&G website to get savings tips and information on relevant programs. EnergyHub also sells separate add-ons to help directly manage usage in response to device information, but they are not provided through the program.	Absolute annual savings of 64 kWh and 0.01 kW savings per-person, based on deemed savings*	Opt-in. General population.	Information Displays; Online Interface	Real-time information through device (kWh) provided every 15 minutes; historical usage; cumulative cost; “push” notification from SCE&G notifying of events; related SCE&G website providing tips and programs; EnergyHub website that provides more detailed usage information and analysis
Low/No Savings							
PowerCost Monitor	Oregon (ETO)	January-August 2008 (9 mos.)	Customers signed up to receive a feedback device. They could either purchase the device from ETO's website at \$29.99 (the normal retail price was \$150), or get it for free during a home energy audit. 200 total customers participated.	Study found no statistically significant difference between treatment and control groups, and savings between 1.6 and 2.6 kWh per day; also found lower savings at 3, 6, and 9-mo. research periods	Opt-in. General population of customers, half offered through ETO website at a discounted price and half offered through home energy audits - all opt-in customers who express interest in saving energy	Information Displays	Instant usage (updates approximately every 30 seconds); total cost per hour; predicted bill; historical usage (up to one month); predicted usage
The Energy Detective (TED)	Mountain View, CA (Stanford & Google)	March 2010-October 2010 (8 mos.)	Test of Google web application using data from The Energy Detective (instead of the TED website). Google employees tested both the device and web interface. 1,065 total employees participated.	Average savings of 5.7% across all participants compared with control groups; however, savings decreased after the first four weeks of use and was at 0%	Opt-in. Targeted a Google employees, originally within California office, then across U.S., stratified by U.S. region	Online Interface; Information Displays	In addition to TED real-time data display (updates every few seconds), Google web interface provided graphs of real-time and historical consumption, bill projections, daily kWh, tips, and email reminders.

Device Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
				compared with control group by the end of the three-month participation period.			
eWeb (Online Dash-board, EID/HAN)	Chicago, IL (ComEd)	June 2011- May 2011 (1 year)	The program was designed to test both dynamic pricing and feedback technologies. Customers were put into one of 25 different study groups (23 treatment, 2 control) that tested multiple combinations of components in feedback programs: dynamic pricing (multiple kinds of rates), educational materials, indirect feedback, and direct feedback. These different treatment groups received different combinations of these materials (such as direct feedback alone, direct feedback with dynamic pricing, direct feedback with educational materials, etc.)	No (0%) overall average per-household kWh savings found; however, this is only among a subgroup of participants in dynamic pricing + EID (about 10%) that participated in DR events and saved more than 20% CPP and 14% peak-time rebate pricing; some EID customers also saved during peak times even if they were not on a special DR rate	Opt-out. Random selection of from general population of homes with AMI smart meters in two areas, outside and inside Chicago	Information Displays & Online Interface	Materials and motivational tactics varied by group. Some received additional educational materials, some received OPOWER normative comparisons, some received notifications of usage and/or DR events, some received EID devices - and some received none of these. Some customers were signed up for different load-based rates such as critical peak pricing or time-of-use, while others were not put on any special rate plan.
Savings Not Calculated							
Tendrill	San Diego, CA (San Diego Gas & Electric)	June-October 2011 (5 mos.)	The program had three components: the Residential Automated Controls Technology (RACT), the Low-Income In-Home Display (IHD), and the Low-income programmable communicating thermostat (PCT) pilots. All 3 were demand response feedback programs. The program provided the technologies for these programs for free,	Not calculated at this time.	Opt-in. Targeted 100 high-usage (700 kWh/mo or more) single-family homeowners with central AC and not enrolled in other DR or renewable programs. The PCT and IHD pilots targeted low-income customers specifically.	Information Displays; Online Interface	Real-time information through device (kWh) provided every 15 minutes; Notifications through the device before DR events; link to a special "energy management" website; ability to track both real-time and historic usage; Biggest Energy Saver (BES) competition which shared and ranked participants' savings from the previous

Device Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
			but did not offer any additional incentives. The program had 207 total RACT participants, 279 IHD participants and 66 PCT participants.				year
AzTech	South Carolina (South Carolina Electric & Gas)	Nov. 2010-Oct. 2011 (1 year)	Phase 1 of 2. Residential pilot. 245 participating customers received the AzTech EID device for free from SCE&G. Device provides usage info every 15 minutes. Customers could also go to SCE&G website to learn about ways to save.	Not calculated	Opt-in. Members of SCE&G "Voice of the Customer" panel.	Information Displays; Online Interface	Real-time information through device (kWh) provided every 15 minutes; historical usage; cumulative cost; estimated bill.

Indirect Feedback Programs Reviewed

Table 83. Summary of Reviewed Indirect Feedback Programs (Highest to Lowest Energy Savings)

Program Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
High Savings							
Efficiency 2.0 (Online Dashboard)	Chicago area, IL (Illinois Citizens Utility Board, ComEd and People's Gas territory)	June 2010-2011 (1 year)	Randomly selected customers receive reports with their monthly bill that compared usage to previous bills and to neighbors' usage; the report also provides access to website for detailed feedback and to sign up for savings goals. 11,682 customers opted in to website information.	Estimated daily per-household kWh reduction of 5%-5.6% compared with control group. Furthermore, savings were 6.01% for participants who signed up on the website, compared with 1.47%-1.63% savings for participants who received the mailer only.	Reports are opt-out, but website is opt-in. General population, randomly selected for treatment and control groups. Going forward the program is planning matching process to identify non-participants most similar to participating customers.	Online Interface; Enhanced Billing Information	Historical usage; usage comparison to neighbors; goal-setting and tracking; customized savings tips; online audits (from ResNet); rewards points for savings, redeemable for discounts; contests and challenges
Moderate Savings							
Aclara (Online Audit)	Eastern Pennsylvania (Pennsylvania Power & Light)	2008-2009 (1 year)	Online home energy dashboard with online audit and savings recommendations. Customers can sign up at one of three levels of commitment: Level 1 is a survey of basic home information (including heating and cooling equipment), Level 2 includes an appliance inventory, and level 3 includes comprehensive home details and customized, changing tips. 9,739 total customers participated in 2008.	Estimated daily per-household kWh reduction in Level 1 was 1.2% (ranging from 0.3% to 2.2%); in Level 2, daily reduction was 1.1% (ranging from 0.6% to 1.6%). For Level 3, estimated daily per-household kWh reduction was 2.9% (ranging from 1.6% to 4.3%).	Opt-in. General population of PPL customers.	Online Interface	Online audit at 3 levels of detail; graphics showing historical usage tracking; pie charts identifying end uses that use the most energy; tips for ways to save based on audit responses; bill-to-date online information. The report notes that PPL also raised their rates significantly (usually around 30%, but up to 35%) in January 2010, and began notifying customers of the upcoming change in mid-2007.

Program Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
Efficiency 2.0 (Online Dashboard)	Western Massachusetts (WMECo)	Nov. 2010-June 2011 (9 mos.)	Pilot program. Customers were randomly selected to receive reports with their monthly bill that compared their usage to neighbors and previous bills; customers could then sign up for more detailed usage analysis and to set savings goals on WMECo website. 25,000 customers received reports, while 7,200 opted in to the online interface.	The evaluation did not calculate overall savings, but found that report-only participants had 0.4% per-household kWh savings. Online participants had 5.5% savings for online-only participants, and 5.7% savings for participants both go reports and opted onto the website.	Reports are opt-out, but website is opt-in. General population, randomly selected for treatment and control groups for reports. Quasi-experimental design for the online component due to its opt-in design.	Enhanced Billing Information; Online Interface	Report provides monthly and annual neighbor comparisons; website provides list of tips, historical usage, neighbor comparisons, goal-setting and tracking, customer rewards (can redeem for discounts), community/social engagement
Enerlyte (Online Dashboard)	Payson City, UT (Payson City Power)	October 2010-October 2011 (1 year)	Customers received a customized utility bill with "energy efficiency report" with feedback on energy usage and neighbor comparison; customers could then sign up for more detailed usage analysis and to set savings goals. Can also set goals working with customer service reps at utility center. 5,000 customers received reports.	2.4% savings per participant compared with control group; 726,000 total kWh savings; however, writers note that the data was not weather normalized	Opt-out. General population, but information collected allows segmentation and targeted messaging.	Enhanced Billing Information; Online Interface	Historical usage comparisons; neighbor comparisons; online audit; efficiency tips; goal-setting and competitions; peak alerts; action plans; mobile app added to provide peak alerts
Efficiency 2.0 (Online Dashboard)	South Carolina (South Carolina Electric & Gas)	April 2011-March 2012 (1 year)	Customers signed up to set energy savings goal and received monthly report showing progress toward that goal, how their usage compared to neighbors, and relevant behavioral tips and related SCE&G programs. 26,901 customers signed up for the program in 2011.	Overall savings of 327 kWh per-person and demand savings of 0.12 kW per-person; however, based on program deemed savings due to study timing. Most participants interviewed met their savings goals, but their goals were modest. Billing analysis	Opt-in. General population	Online Interface; Enhanced Billing Information	Monthly benchmarking report (mail or online dashboard) that shows progress toward overall savings goal; Like Home Comparisons of monthly usage; relevant savings tip

Program Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
				planned for 2012.			
BC Hydro (Online Dashboard)	British Columbia (BC Hydro)	"Early 2007"- 2008 (1 year)	Pilot program. Customers signed up for an energy savings goal on BC Hydro "Team Power Smart" website. Customers could set one of several levels of goals: 5%, 10% or 20%. Customers who met their goal received cash rebates equal to cost of energy saved (e.g. a 5% reduction led to rebate equal to a rebate payment equal to cost of energy saved). The program was rolled out to all customers in October 2007 and is currently still in place in BC Hydro territory.	Precise savings not calculated, but program administrators found that about half of customers saved energy, though only 20% met their savings goals. Customers with 5% savings goals were most likely to meet it (41% met), while customers with 20% savings goals were least likely to meet it (7% met). Control group could sign up for goal but did not receive any incentives for meeting it - they had about 14% reach goal, 32% save and 55% increase	Opt-in. Pilot program, targeted general population customers that were employees of BC Hydro's "largest customer." However, noted that future programs in the same vein would target "stumbling proponents," customers who had positive attitudes toward saving energy but taking few actions, estimated to be about 20% of customer population	Online Interface; Email Communication	Online tool to track and compare historical usage, set goals and track progress toward goal, and get tips to reduce consumption. BC Hydro also sent electronic reminder newsletters to encourage customers to visit the site regularly.

Program Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
BC Hydro (Online Dashboard))	British Columbia (BC Hydro)	2008-2010 (2 years)	Full program rollout of pilot described above. Customers sign up on BC Hydro page to set energy savings goal on "Team Power Smart" website to set a total one-year kWh savings goal of 10% only. (Note this goal-setting changed from the pilot.) Customers who meet the goal receive cash rebates equal to the cost of the energy saved. Total participants estimated at 300,000, and 75,000-80,000 in the 2009-2010 period.	Estimated annual per-household kWh reduction by 2010 was 208 kWh per person. Estimated annual per-household savings percentages ranged from 0-16%. Participants who did not meet 10% goal had average savings of 4-5%. Program administrators estimate that 75% of customers had measurable energy savings; however, only 20% of participants met the savings goal of 10%.	Opt-in. General population, but conducted segmentation to find target group and focuses mostly on them. Lately has been expanding away from this group.	Online Interface; Email Communication	Online tool to track and compare historical usage, set goals and track progress toward goal, and get tips to reduce consumption. BC Hydro also sent electronic reminder newsletters to encourage customers to visit the site regularly. Also conducts events and in-person outreach, including a loyalty program to keep customers engaged over time.
Ambient Energy Orb (Online Dashboard)	CA Statewide (SCE, PG&E, SD&GE)	Summer 2005 (3 mos.)	Part of a rate program where customers were charged higher rates during peak demand period. Customers were linked to a website (or received mailed reports) that provided detailed bill analysis on their overall usage. Customers also received an "Energy Orb," a globe-shaped light that displayed different colors during peak demand periods to notify the customer when to save.	Estimated per-household savings of 0.061 kW per peak period (2pm-7pm) per day; this was consistent with every daily peak hours and did not change on specific DR days; percentages were not specified but found greater savings in treatment group than control group. Note that total savings were not calculated.	Opt-in. Recruitment within customers already on critical peak pricing rate	Online Interface; Information Displays	Increased rates during peak demand periods; detailed analysis of past usage; bill analysis that shows detailed usage during peak period (2pm-7pm); email "push" notifications to encourage customers to use the website; changing color of the "Energy Orb" during peak demand periods
Low/No Savings							

Program Type	Location	Timing	Program Description	Energy Savings	Customer Targeting	Feedback Tools	Motivational Tactics
Aclara (Online Audit)	Arizona (Arizona Public Service)	2009-2010 (1 year)	Nearly identical to PPL program, Aclara is an online home energy dashboard with online audit and savings recommendations accessed via the customer's online bill. Customers can sign up at one of three levels of commitment: Level 1 is a survey of basic home information (including heating and cooling equipment), Level 2 includes an appliance inventory, and level 3 includes comprehensive home details and customized, changing tips.	No (0%) overall average per-household kWh savings found; however, for customers in highest tier of energy usage (top one-third in terms of annual usage), usage was reduced 6.3%. Within the highest-level users, Level 1 participants reduced 275 to 450 kWh annually; Level 2 participants reduced 361 to 727 kWh annually; and Level 3 participants reduced 357 to 1461 kWh annually	Opt-in. General population targeted, but also tested for differences by usage tier (lowest third, middle third, highest third).	Online Interface	Online audit at 3 levels of detail; graphics showing historical usage tracking; pie charts identifying end uses that use the most energy; tips for ways to save based on audit responses; bill-to-date online information.

Evaluation Best Practices

We also examined some of the best practices in evaluation of feedback programs. We found that evaluations have been increasingly using billing analysis with a control group. The need for billing analysis is not surprising, as there are no set measures or behaviors, and therefore no truly predictable savings, associated with these programs. However, billing analysis is time-consuming and, therefore, expensive. Only one utility (South Carolina Electric & Gas) has developed deemed savings for its feedback programs, but even they are planning to verify these deemed savings through billing analysis in fall 2012.

Some savings analyses include a true control group, comprising random assignment of interested participants into control and treatment groups. Some billing analyses use comparison groups of later participants, so that the level participant interest in behavioral programs is represented in both the treatment and comparison groups, particularly for opt-in programs. Older billing analyses (including the SRP and Florida studies) used the general population as the basis for comparison.

One area that has not been studied thoroughly at this point is persistence of behaviors for these programs. Most programs use one year of billing data as the basis for comparison; however, as many of these programs are relatively new, the question of persistence has not yet been definitively answered.

Table 84 provides an overview of the methodologies used in measuring savings. One key issue of comparison between indirect and direct feedback programs is sample size: Indirect feedback programs tend to have much larger sample sizes (often reaching out to the whole population) than direct feedback programs.

Table 84. Evaluation Research Designs by Program (Organized by Type and Year)

Report	Sample Size	Duration	Calculations	More than 1 Year?
Experimental Design				
ComEd Energy Report Pilot (Indirect & Direct)	8,500 total customers (675 in control groups, 7825 among various treatment groups)	June 2011-May 2011	ANOVA of mean energy usage; regression analysis of event load days, used control group	N
Energy Center of WI PowerCost Monitor Study (Direct)	218 treatment, 95 control	Spring 2008-Summer 2009	Billing analysis with control group	N
ETO PowerCost Monitor Pilot (Direct)	200 treatment, 691 control participants	January-August 2008	1-year Billing analysis with control group planned, but interim data available from 9 mos. of billing data	N
Hydro One PowerCost Monitor Pilot (Direct)	500 treatment, 52 control	Summer 2004-September 2005	Billing analysis with control group	Y (18 mos.)
WMECo Efficiency 2.0 Program (Indirect)	25,000 customers received mailed reports, 25,000 in control group. 7,200 opt-in participants using online interface (among the 25,000 contacted)	November 2010-June 2011	Billing analysis with control group	N
Payson City Power	est. 5,000 treatment	October 2010-	Billing analysis with	N

CLC Feedback Program Literature Review Memo

Enerlyte Pilot (Indirect)	group, 500 control group	October 2011	control group	
Illinois Citizens Utility Board Efficiency 2.0 Program (Indirect)	2,925 treatment group, 3,382 control group (for website engagement); 14,855 treatment group, 60,065 control group (for reports)	June 2010-2011	Billing analysis with control group	N
Quasi-Experimental Design				
South Carolina Electric & Gas EnergyHub In-Home Display Program (Phase 2) (Direct)	3,117 total participants; comparison group not yet defined	October 2011-July 2012	Billing analysis with comparison group (to be conducted fall 2012)	N
South Carolina Electric & Gas My Home Energy Report (Indirect)	26,901 total participants; comparison group not yet defined	April 2011-March 2012	Billing analysis with comparison group (to be conducted fall 2012)	N
Cape Light Compact In-Home Display Pilot (Direct)	91 parts, 96 interested non-parts, 100 random non-parts	Spring 2009-February 2010	Billing analysis; quasi-experimental design	N
Arizona Public Service Aclara Program (Indirect)	36,905 in participant group; 8,870 in comparison group	2009-2010	Billing analysis; quasi-experimental design (2009 participants' usage compared with usage of 2010 participants during 2009 (i.e., before participating in program))	N
BC Hydro Team Power Save Program (Indirect)	300,000 total participants, 75-80,000 estimated in 2009-2010 period	2008-2010	Billing analysis with non-participant group (not described)	N
Pennsylvania Power & Light Aclara Program (Indirect)	9,739 total treatment group; 6,659 comparison group	2008-2009	Billing analysis, quasi-experimental design (2009 participants were comparison group for 2008 participants during 2008).	N
Massachusetts PowerCost Monitor Pilot (Direct)	377 NGRID participants, 32 WMECo participants, 3103 NSTAR participants	May 2007-November 2007	Billing analysis with comparison group	N
California Critical Peak Pricing Pilot (Indirect)	152 participants, 118 control	Summer 2005	Difference of differences analysis of hourly load impacts; experimental design with control group	N
Stanford & Google In-Home Display and Web Application Study (Direct)	1065 total households	March 2010-October 2010	Difference of differences analysis of information recorded by device (no billing data); control group for first three months was	N

			treatment group for final five months	
Salt River Project M-Power In-Home Display Program (Direct)	estimated 30,000 participants during study period	October 2005-October 2006	Billing analysis by SRP; used comparison group of general customers on standard rate	N
Research Institute of Central FL In-Home Display Pilot (Direct)	17 participants, 2million general population utility customers (from customer database of Florida Power & Light)	Sept. 2005-Aug. 2007	Billing analysis with comparison group (used total general population of Florida Power & Light Customers, did not include random assignment)	Y (2 years)
No Savings Studied				
San Diego Gas & Electric Tendril In-Home Display Pilot (Direct)	99 TECH participants, 108 in IHD participants in RACT (non-low-income) group; 66 PCT participants and 279 IHD participants in low-income group	Installation conducted June to August 2011, DR events called from Aug. to October 2011	Savings not calculated at this time	N
South Carolina Electric & Gas AzTech In-Home Display Program (Phase 1) (Direct)	245 pilot participants; control group not used	November 2010-October 2011	Savings not calculated	N
BC Hydro Team Power Save Pilot (Indirect)	Sample sizes not described	"Early 2007"-2008; full program rolled out in 2008	Goals (not savings) tracked; Quasi-experimental design ("control" group did not get incentives but still got information)	N

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I. CLC SHEMP COMPARISON GROUP SELECTION

Selecting Matched Comparison Households

In the analysis approach presented in the methodology section, whether the estimate of savings is accurate—statistically speaking, efficient and unbiased—depends on selecting comparison households that accurately represent the counterfactual behavior of program participants. We take the perspective that the best matches for program household k are those households whose monthly energy consumption during a period before household k 's enrollment in the program most closely matches household k 's consumption during the same period. The underlying logic is that households with energy consumption closely matched over an extended period demonstrate that they respond the same to the many exogenous factors—weather in particular—that drive energy consumption.

From a statistical perspective, an argument to include other observable variables in the match must follow from the logic that these other variables are correlated with any separation in the match during the post-enrollment period that is not due to the effect of the program nor to other variables included in the analysis, and that the values of these other observable variables are different on average for the program and comparison households. With this in mind, we also account for electric heat in the development of the matches.

The matching method used to develop the comparison group for Energize households is the following two-stage process. For each program participant, energy consumption in the M months before program enrollment was compared to *all* CLC residential customers with billing data over the same M months—roughly 162,000 customers. The basis of comparison is the difference in monthly energy use between a participant and its match, DPM_t . Denoting by SSD the sum of squared DPM_t over the matching period, the ten CLC non-pilot residential customers with the lowest SSD were chosen as “finalists” for the participant (first stage). From the ten finalists, three customers were chosen to be included in the analysis (second stage). Typically, these three were the matches with the lowest SSD *and* the same heat type. If there were not at least three finalists with the same heat type, the three matches included in the analysis were chosen sequentially as follows: (a) all finalists with the same heat type; (b) the remaining finalist(s) with the lowest SSD.

Matches for Energize customers were for both 12 months and 24 months before the start of the pilot (in other words, we conducted the analysis for Energize customers using two sets of matches). The energy use by Energize households and their matches during the matching period is presented in Figure 52 and Figure 53.

Matches for Legacy households followed the same basic process as used for Energize households, except that the matches were for only 12 months due to the available data, and two approaches for the second stage of the matching were used. The first approach followed the process described above—matches were based on minimizing SSD subject to having the same heat type (standard matches). In the second approach, matches were based on minimizing the linear trend of DPM during the matching period, subject to having the same heat type (low trend matches). In the next section, we provide the rationale for this second approach. The energy use for Legacy households and their matches during the matching period is presented in Figure 54.

Figure 52. Comparison of the Average Monthly Consumption of Energize Households and Their 12-Month Matches in the 12 Months Before Pilot Enrollment

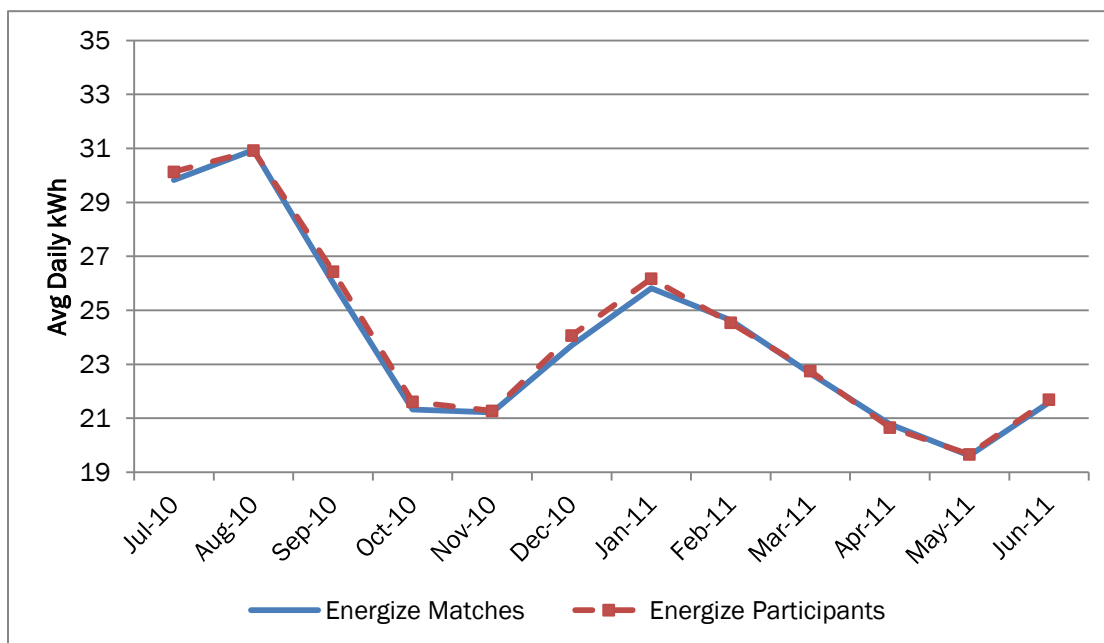


Figure 53. Comparison of the Average Monthly Consumption of Energize Households and Their 24-Month Matches in the 24 Months Before Pilot Enrollment

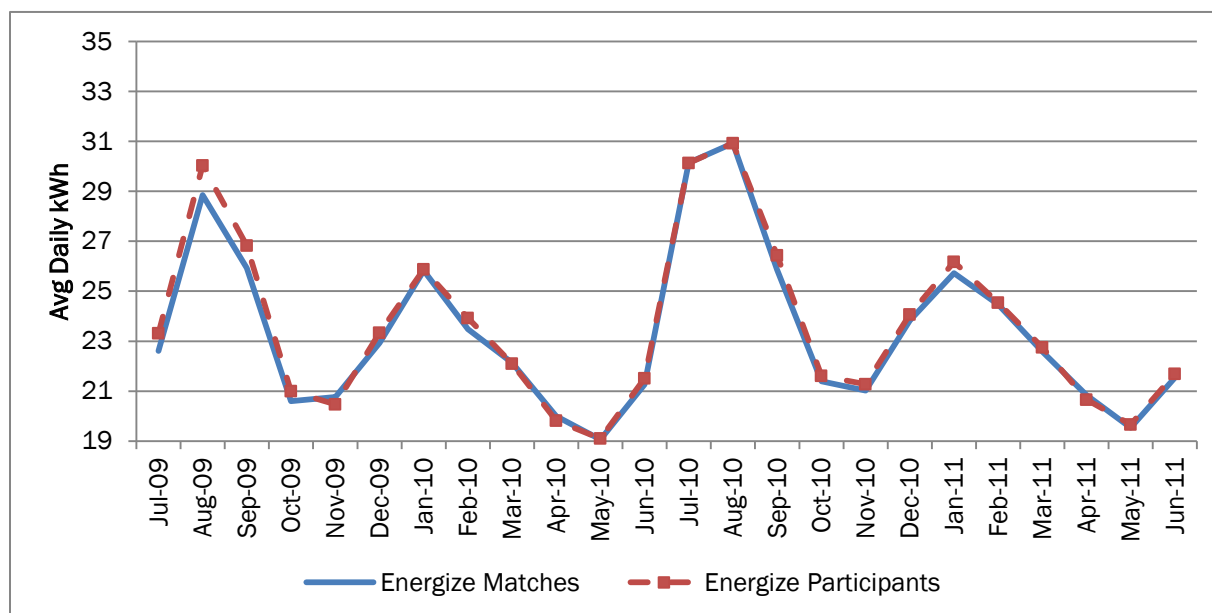


Figure 54. Comparison of the Average Monthly Consumption of Legacy Households and Their Standard Matches in the 12 Months Before Pilot Enrollment

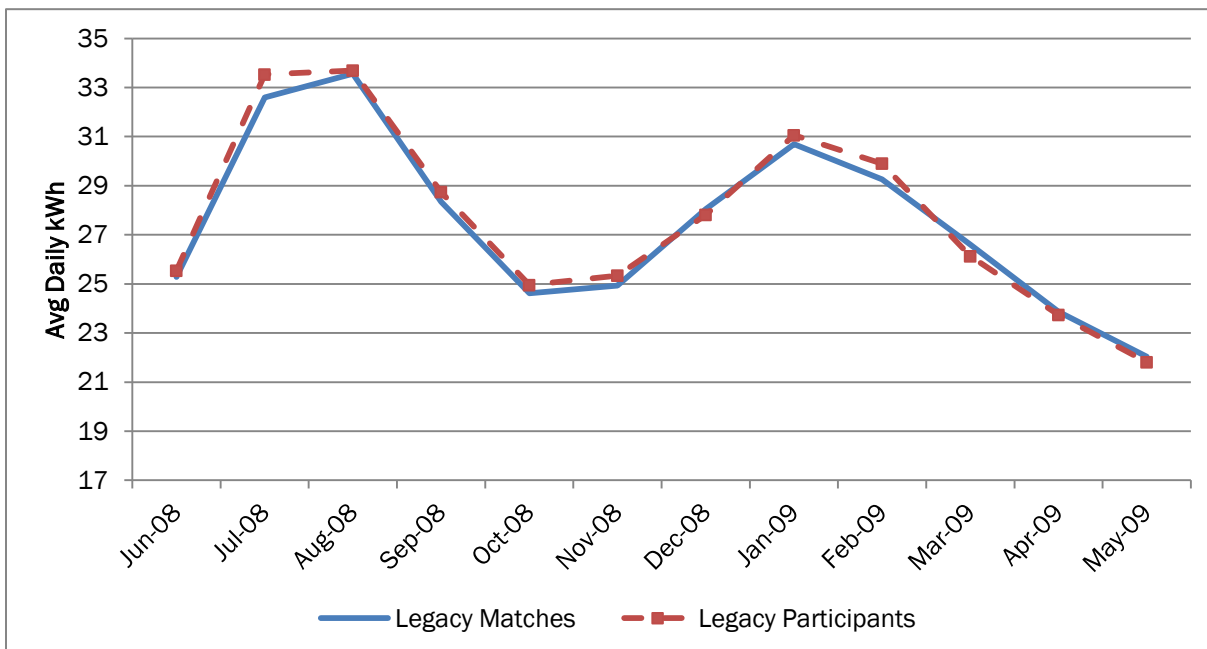
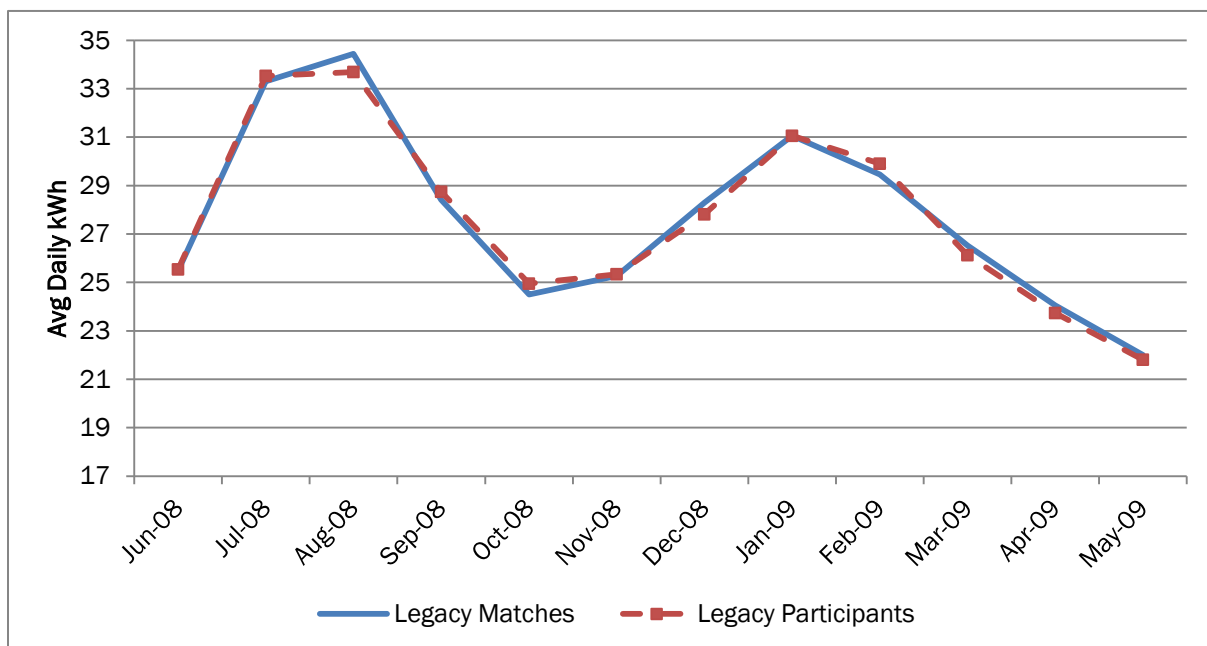


Figure 55. Comparison of the Average Monthly Consumption of Legacy Households and Their Low-Trend Matches in the 12 Months Before Pilot Enrollment



The Issue of Selection Bias in the Estimate of Pilot Savings

The analysis described above attempts to estimate the average pilot effect on pilot participants. The function of the matched comparison households is to provide an estimate of the counterfactual (baseline) energy use by participants—the energy use by participants if they were not in the pilot. As noted previously, matching estimators are designed to eliminate model specification bias, by assuring that the distribution of covariates X conditioning the counterfactual estimate is the same as that under treatment. With respect to energy use, by far the most important conditioning variable is pre-pilot energy use in the same billing period of the previous year. This variable, along with monthly fixed effects, accounts for about 95% of the variation in energy use over a 1-year period. The implication is that given a model that matches on pre-pilot energy use, with regression correction as advocated by Imbens and Woolridge (2008) and used in Model 2, we are highly likely to generate an excellent counterfactual for participants.

Accepting that the analysis approach addresses model specification bias, we turn to the question of selection bias. In the current context, selection bias is the result that the counterfactual derived from the matches overstates/understates the energy use by participants during the program year (in the absence of the program) due to unobservable differences between the two groups. It implies, in other words, that even though the participants and their matches behave very similarly for 12-24 months, it remains plausible that in the absence of the pilot their energy use would not be the same on average over the next 12 months because unobservable factors cause systematic differences between the two groups.

For behavioral programs, it is difficult to develop a convincing argument for selection bias given good matches based on pre-program billing history. The most likely standard narrative concerning unobserved differences between participants and comparison households does not support the argument for selection bias. This story is that the participants are more likely than the typical household to behave like “energy hawks”—always on the lookout for ways to save energy—and that this behavioral characteristic is what drove them into the program. Given good matches over a long horizon, though, this argument is unpersuasive because the matches are observationally equivalent; they act as if they have a similar behavioral propensity.

More generally, matches based on the energy use history account for selection bias due to “stable” differences between participants and the general non-participant population with respect to energy use. Suppose an underlying set of unobservable variables Z reflect a household’s behavioral propensity to save energy, and these variables are correlated with participation in the program. One can reasonably expect that close matching on the energy use history will, on average, generate the same distribution of Z among the matched households as among the participant households. As observed by Stuart (2010),

“This assumption [nonconfoundedness] is often more reasonable than it may sound at first since matching on or controlling for the observed covariates also matches on or controls for the unobserved covariates, in so much as they are correlated with those that are observed” (pg. 3).⁵⁸

In other words, the *behavioral* narrative for selection bias is necessarily reflected in a parallel *statistical* narrative. The statistical argument has to be that in the regression model there are

⁵⁸ Stuart, E.A. “Matching Methods for Causal Inference: A Review and a Look Forward”. *Statistical Science*, 25(1), February 2010, 1-21. In the current context, the assumption of “nonconfoundedness” implies the assumption of no selection bias.

unobservable variables affecting energy use at time t that are correlated with the participation decision. Note, though, that unless these same variables do not affect energy use in the pre-program year, their effect is largely absorbed by the pre consumption variable $PREkWh$, thereby eliminating the associated selection bias.

The claim that longer matching horizons do a better job of driving selection bias from the analysis implies the assumption of greater stability of Z . There is no right/wrong answer to the question of the correct matching horizon, though to account for seasonal effects it is clear that the minimum match horizon should be 12 months. It is worth mentioning that matching on demographic variables implies that Z is invariant over time—perfect stability—and relatively highly correlated with the matched demographic variables.

A pseudo-test for selection bias

It is not possible to statistically test for selection bias, but Imbens and Woolridge (2010) present a test that is suggestive. In the current context, the logic of the test is that in the absence of selection bias the difference between participants and matches in average energy use (D_{PM}) should be no different just before the start of the program than during the preceding months, and no different in the months preceding the matching period than during the matching period. In other words, we should observe no statistically discernible trend in D_{PM} . If we do detect a trend then we suspect selection bias. Note the consistency of the logic of this test with the energy hawk narrative.

In the current context, a simple implementation of the test is to determine whether, given matching based on months $t=1,...M$ before the start of the matching period, D_{PM} in months $t=1,2$ is drawn from the same distribution as D_{PM} in months $t=3,...M$, and D_{PM} in months $t=M+1, M+2,...$, is drawn from the same distribution as D_{PM} in months $t=1,...M$.

Figure 56 presents D_{PM} for Energize customers and their 24-month matches over the period February 2008 to September 2012. The period on which matches are based is roughly June 2009 to May 2011 (“roughly” because different participants entered the pilot in different months over the 3-month period June 2011-September 2011, and the 24-month matching period reflects this). The figure makes clear two features related to the potential for selection bias:

- During the pre-pilot period the difference in energy use between participants and their matches is very small on average, and there is no trend in the difference;
- There is a sharp drop in the difference at the start of the pilot.

Applying the pseudo-test for selection bias indicates no evidence of selection bias.

Figure 56. Difference between Participants and Matches in Average kWh/Day (D_{PM}), Energize Customers, 24-Month Matches (Participants-Matches)

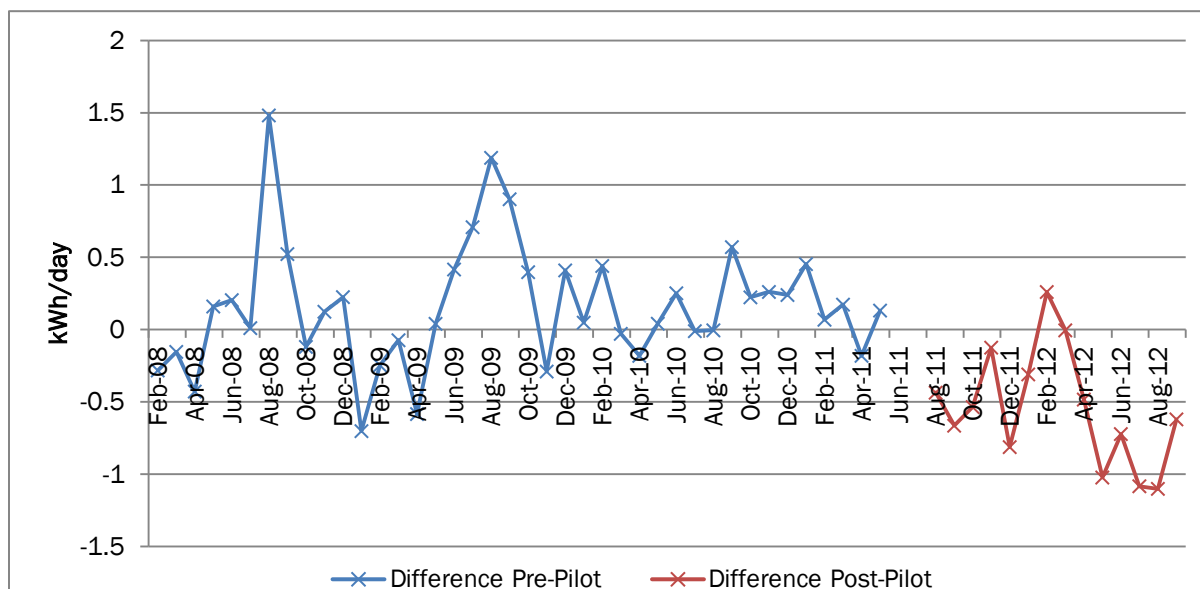


Figure 57 presents D_{PM} for Energize customers and their 12-month matches over the same period. The matching period is roughly June 2010 to May 2011. Once again there is a sharp drop in D_{PM} at the start of the pilot, which is highly suggestive of program effect, but in this case there is a slight trend in the data, and in fact statistical testing indicates that for many months prior to the start of the matching period D_{PM} is not drawn from the same distribution as that implied by the observations of D_{PM} during the matching period. For this reason, in the modeling of pilot impacts, we favor the results obtained with the 24-month matches.

Figure 57. Difference between Participants and Matches in Average kWh/Day (D_{PM}), Energize Customers, 12-Month Matches (Participants-Matches)

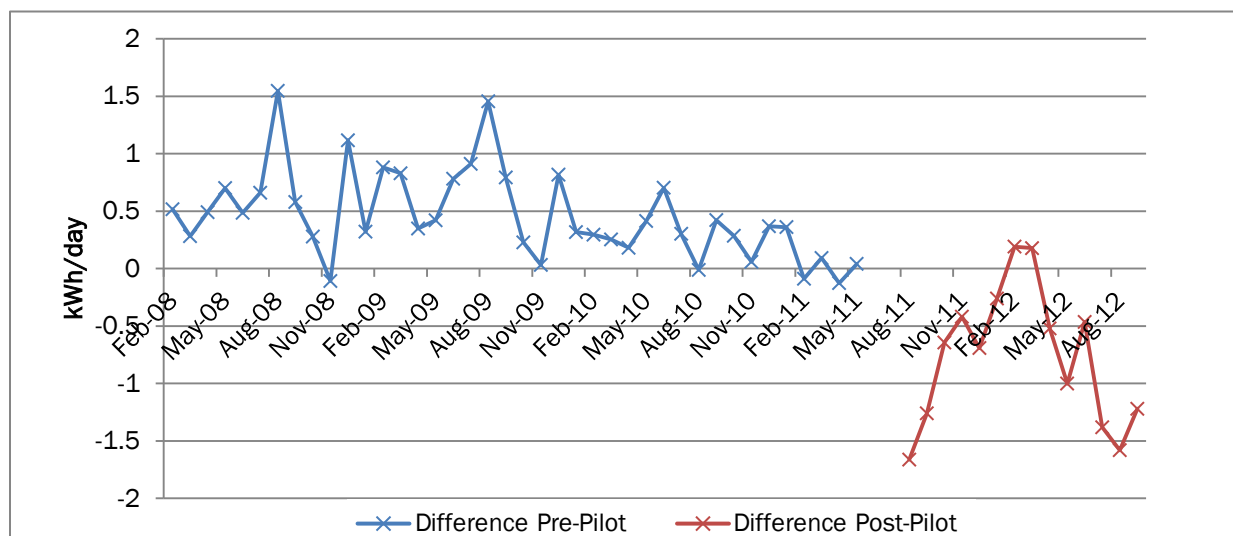


Figure 58 presents D_{PM} for Legacy customers and their 12-month standard matches. Statistical testing does not reject the conclusion that D_{PM} in the last month of the pre-pilot period is drawn from the same distribution as that for the 11 months prior, but there does appear to be a trend in D_{PM} in

the pre-pilot period, and the observation of D_{PM} in the month before the start of the pilot is more than one standard deviation from the average.⁵⁹ Consequently, we drew a second set of matches as described in the previous section, in which the second stage gave preference to matches for which the D_{PM} has the lowest trend over the matching period. Figure 59 presents the graph of D_{PM} for these low-trend matches. The trend is substantially reduced and the observation of D_{PM} in the month before the start of the pilot is now well within one standard deviation of the mean D_{PM} of the previous 11 months.

Figure 58. Difference between Participants and Matches in Average kWh/Day (D_{PM}), Legacy Customers, Standard Matches (Participants-Matches)

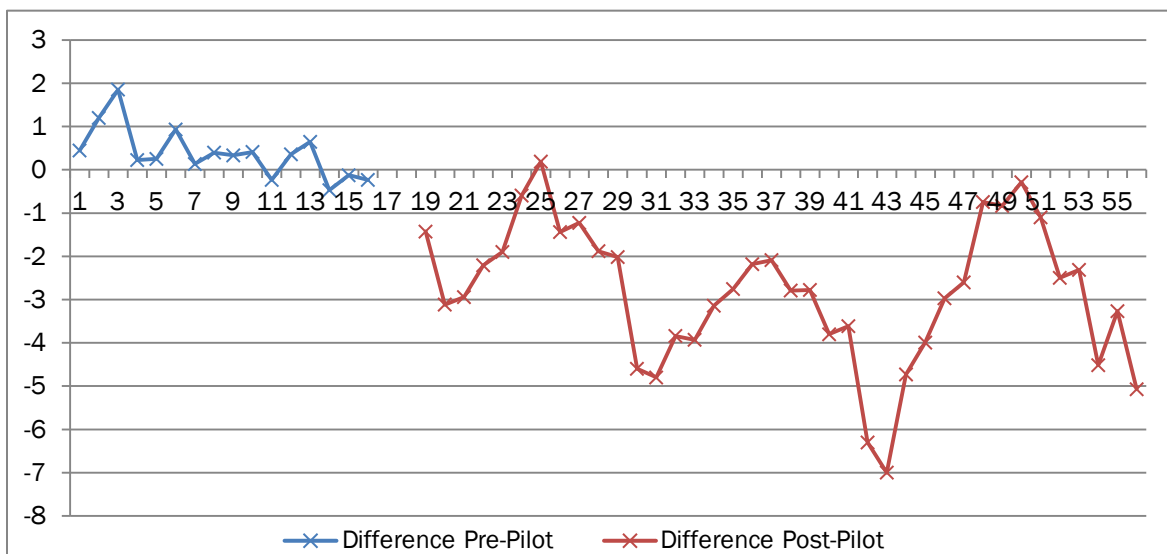
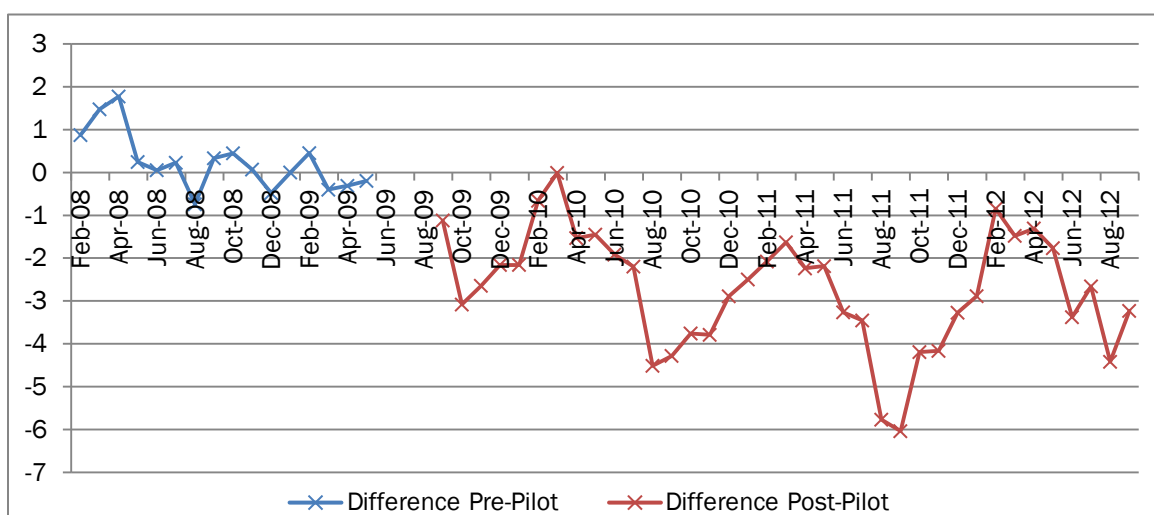


Figure 59. Difference between Participants and Matches in Average kWh/Day (D_{PM}), Legacy Customers, Low-Trend Matches (Participants-Matches)



⁵⁹ We did not have data to test whether D_{PM} before the start of the matching period is drawn from the same distribution as that in effect during the matching period.

Correcting for selection bias

The available evidence strongly supports the argument that the analysis does not suffer from selection bias. Still, it is worth considering taking steps to correct for selection bias, because whether selection bias exists is not knowable. The standard correction for selection bias involves two-stage instrumental variables (IV) analysis. This approach requires identifying variables correlated with the participation decision but assumed to be *not* correlated with the error term of the regression model of monthly energy use used to estimate program savings (in this case, the regression model of Model 1). IV analysis necessarily involves a loss of efficiency in the estimate of program savings because the participation decision is replaced by a prediction of the participation decision. Moreover, in small samples such as used in this analysis, weak instruments—instrumental variables not highly correlated with the participation decision—can generate biased estimates of savings. IV analysis can be, in other words, a cure worse than the disease.

Healthy skepticism about IV analysis aside, the evaluation team's survey of Energize participants and matched comparison households included a number of questions believed to hold promise as good IV variables, in the sense that one could make a reasonable case that responses would not be correlated with the error term of the regression model while being reasonably correlated with the participation decision. A total of 54 pairs of surveys for Energize households and matched comparison households were completed. The matched comparison households were drawn from the list of ten candidate 12-month matches (see section 0, "Selecting matched comparison households"). Only three of the survey questions generated responses that were sufficiently correlated with the participation decision to warrant consideration as IV variables (absolute value of the correlation in parentheses):

- P1b: "I always try new technologies before other people do" (0.282);
- P1c: "I trust my utility" (0.161);
- P1h: "I am more likely to change my actions if people I respect have already taken action" (0.104).

Regressing these variables along with the covariates in Model 2 that vary across customers (in particular, *PREkWh* and the *EE* variables) on the participation decision—the first stage of IV estimation, generated a Wald statistic of 5.30. This is a very low value indicating that instrumental variable analysis is highly problematic. The second stage of the IV analysis generated an estimate of program savings that was the wrong sign, wildly disproportionate (net savings over *negative* 10%), and not statistically significant. In view of the result from the first stage of the IV analysis, and the analysis presented above indicating that selection bias is not an issue this result is not considered in the discussion of analysis results.

Summary on the issue of selection bias

In summary, selection bias is not deemed to be a significant issue in the statistical analysis of savings by participants. If it were, the standard statistical recourse to address it—instrumental variables regression—would be very unlikely to generate clearly more accurate estimates of program savings.

J. CLC SHEMP PARTICIPATION ANALYSIS

Table 85. Legacy and Energize Participation in Other CLC Programs

	Legacy Participants (n=77)							Energize Participants (n=277)						
	Legacy (Pre)		Legacy (Post)		Legacy Difference			Energize (Pre)		Energize (Post)		Energize Difference		
Participation Type	n	%	n	%	n diff (Post - Pre)	% diff (Post - Pre)	p-value	n	%	n	%	n diff (Post - Pre)	% diff (Post - Pre)	p-value
Participation in at Least One Program	24	31.17%	43	55.84%	19	24.68%	0.00	169	61.01%	67	24.19%	-102	-36.82%	0.00
Participation in Low-Income Single Family	0	0.00%	2	2.60%	2	2.60%	0.16	4	1.44%	2	0.72%	-2	-0.72%	0.32
Participation in Residential Home Energy	15	19.48%	29	37.66%	14	18.18%	0.01	135	48.74%	45	16.25%	-90	-32.49%	0.00
Participation in Residential Products & Services	12	15.58%	29	37.66%	17	22.08%	0.00	74	26.71%	27	9.75%	-47	-16.97%	0.00
Participation in Multi-Family Retrofit	0	0.00%	0	0.00%	0	0.00%	.	0	0.00%	1	0.36%	1	0.36%	0.32

Figure 60. Cape Light Compact Overall Pilot Participation – Energize Customers

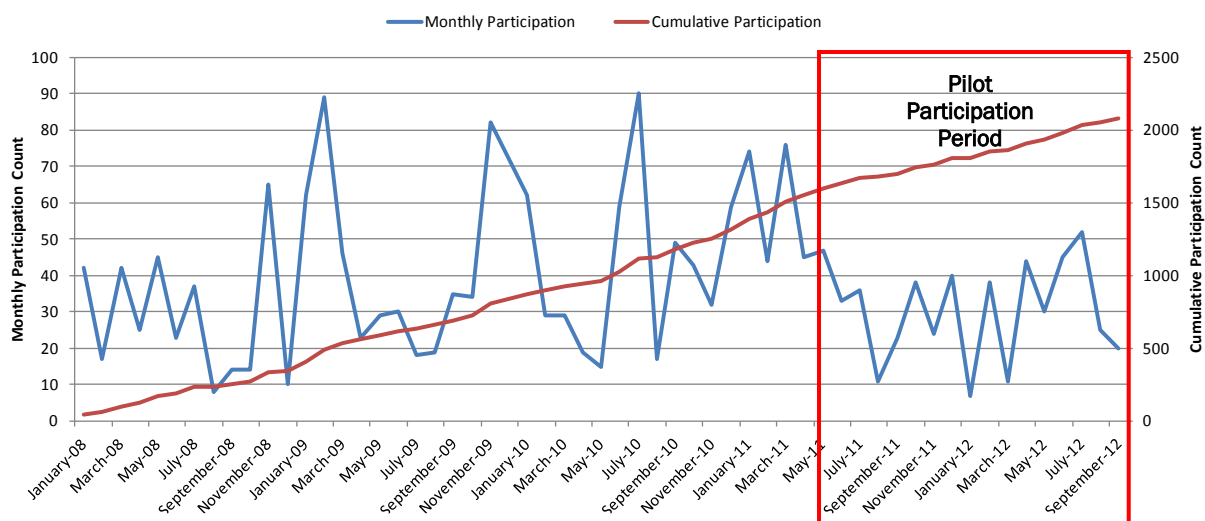


Figure 61. Cape Light Compact Monthly Pilot Participation – Energize Customers

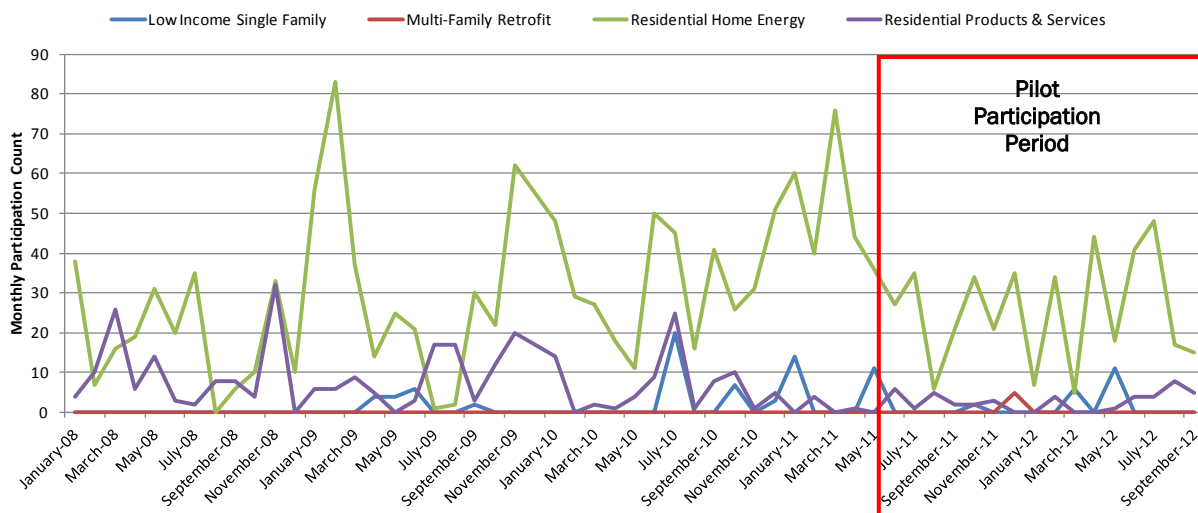


Figure 62. Cape Light Compact Cumulative Pilot Participation – Energize Customers

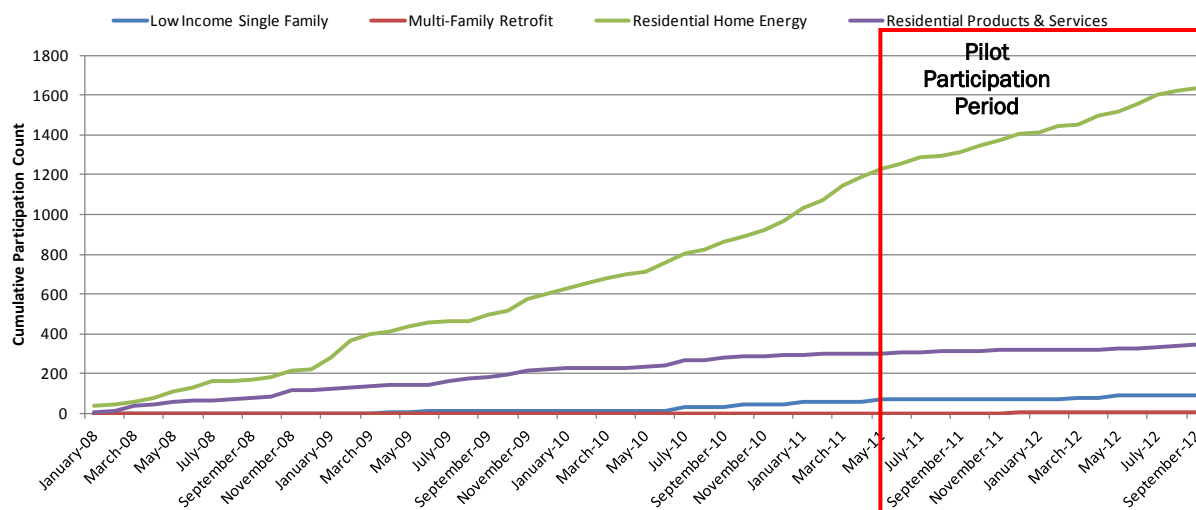


Figure 63. Cape Light Compact Overall Pilot Participation – Legacy Customers

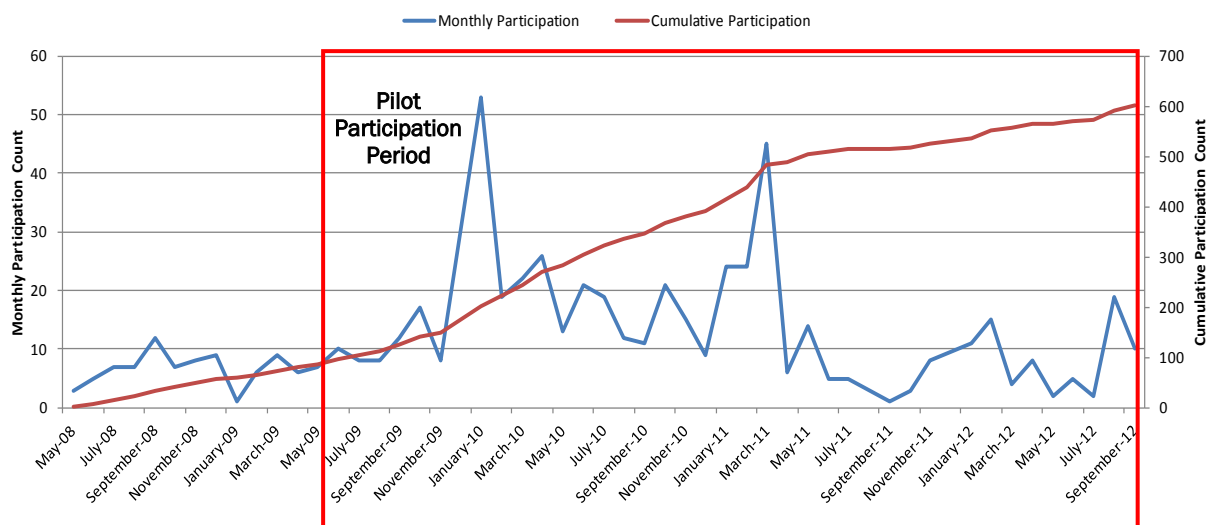


Figure 64. Cape Light Compact Monthly Pilot Participation – Legacy Customers

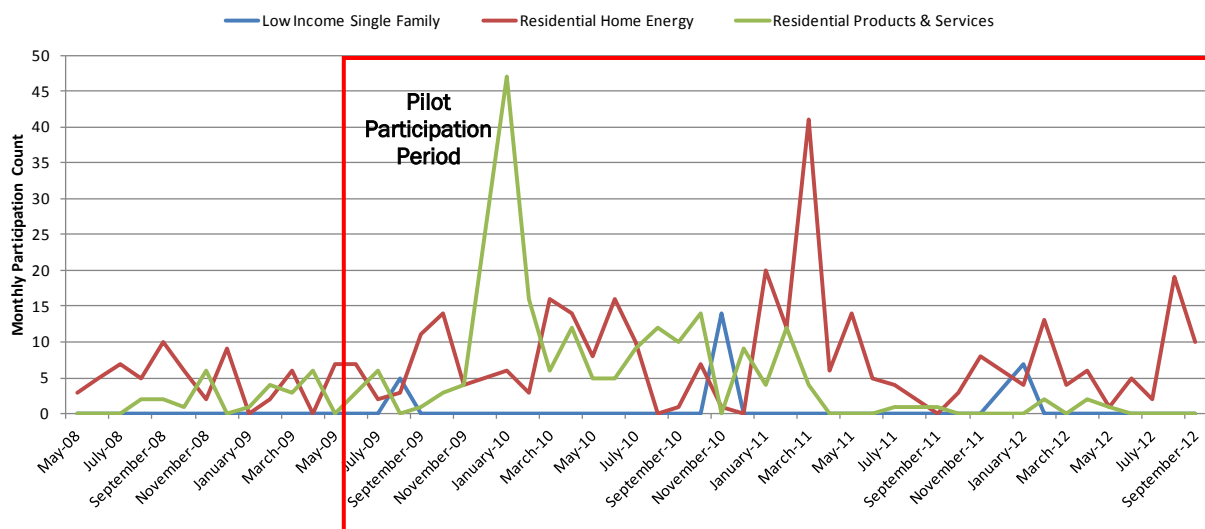
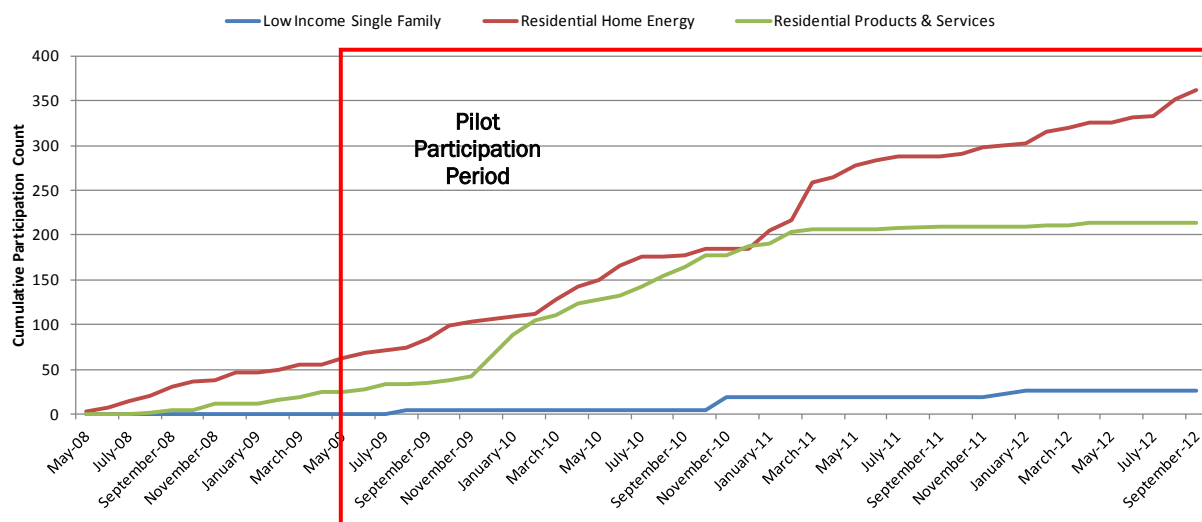


Figure 65. Cape Light Compact Cumulative Pilot Participation – Legacy Customers



K. CLC PRE-POST SURVEY WITH COMPARISON GROUP

The goal of this questionnaire is to collect two pieces of information: (1) post data on CLC SHEMP participants' behaviors and responses to the pilot, and (2) responses to attitudinal and demographic questions among the participant and comparison group to use in the final impact analysis. The table below summarizes the questions to be received by each surveyed group.

Survey Question Category	Participant Group	Comparison Group
Demographics	Yes, to be used in the final impact evaluation in support of a mills ratio or adjustment factor in impact models.	
Psychographics, Media preferences, Satisfaction and Engagement with CLC	Yes, to be used in the final impact evaluation in support of a mills ratio or adjustment factor in impact models.	
Actions Taken	Yes, to be compared with pre-data.	No, pre-period data will be used as the comparison point to estimate changes in behavior among the participants.
Political Ideology	Yes, to be used in the final impact evaluation in support of a mills ratio or adjustment factor in impact models.	

Phone Recruiter

[IF PART=1]

Hello, my name is _____ with Opinion Dynamics Corporation calling on behalf of Cape Light Compact. We are conducting a follow-up study to understand your home energy use to help improve Cape Light Compact programs. You were selected to participate in this survey because you completed a similar survey for Cape Light Compact's Smart Home Energy Monitoring Pilot last year. The survey will ask you questions regarding energy saving actions and practices your household may have taken since participating in the pilot. Your responses will be kept confidential and your name will not be revealed to anyone.

[IF PART=2]

Hello, my name is _____ with Opinion Dynamics Corporation calling on behalf of Cape Light Compact. We are conducting a study to help improve Cape Light Compact programs. Your responses will be kept confidential and your name will not be revealed to anyone.

(Who is Cape Light Compact? Cape Light Compact is an inter-municipal organization made up of all 21 towns of Barnstable and Dukes counties. They administer regional energy efficiency programs and negotiate lower electricity rates for all electric ratepayers on Cape Cod and Martha's Vineyard.)

C1. Are you currently talking to me on a regular landline phone or a cell phone?

1. Regular landline phone
2. Cell phone
98. (Don't Know)
99. (Refused)

C2. Are you currently in a place where you can talk safely and answer my questions?

1. Yes
2. (No, schedule a callback)
3. (No, do not call back)
8. (Don't know, schedule a callback)
9. (Refused, schedule a callback)

Screener[ASK IF PART=1]

S1. Please confirm that the following is still your primary residence: [READ IN <street_addr> <unit> <city>]

1. (Yes)
2. (No)
98. (Don't Know)
99. (Refused)

[THANK AND TERMINATE IF S1=2,98,99]

Demographics

[INCLUDE D5-D6 IN DAILY DISPO REPORT]

D5. Over the past year, has there been a change in the number of people who live in your household on a full time basis?

1. Yes, an increase in occupancy
2. Yes, a decrease in occupancy
3. No change
98. (Don't Know)
99. (Refuse)

D6. Has your household income changed in the past year?

1. Yes, it has increased
2. Yes, it has decreased
3. No change
98. (Don't Know)
99. (Refuse)

[SKIP TO NA1 IF D6 = 3, 98, 99]

DE6. Please stop me when I get to the range of your household's total annual income before taxes:

1. Less than \$25,000
2. \$25,000 - \$34,999
3. \$35,000 - \$49,999
4. \$50,000 - \$74,999
5. \$75,000 - \$99,999
6. \$100,000 - \$149,000
7. \$150,000 - \$199,999
8. \$200,000 or more
98. (Don't know)
99. (Refused)

Participant-only Post-Program Questions

Awareness of Energy Consumption [ASK IF PART= 1]

NA1. How do you think your household's current energy use compares to your energy use last year? Is it...

1. Much higher
2. Slightly higher
3. About the same
4. Slightly lower
5. Much lower
98. (Don't know)
99. (Refused)

[ASK IF NA1=1,2,4,5]

QNA1a. Why do you think your household's current energy usage is <QNA1> than it was last year?
[OPEN RESPONSE]

NA2. How do you think your household's current energy use compares to similar homes in your neighborhood? Is it...

1. Much higher
2. Slightly higher
3. About the same
4. Slightly lower
5. Much lower
98. (Don't know)
99. (Refused)

[ASK IF NA2=1,2,4,5]

QNA2a. Why do you think your household's current energy usage is <QNA2> than similar homes in your neighborhood? [OPEN RESPONSE]

NA5. If you had an opportunity to advise your friends or neighbors on how to save energy in their homes, what would be your top 3 recommendations?

1. [OPEN RESPONSE]
2. [OPEN RESPONSE]
3. [OPEN RESPONSE]
98. (Don't know)
99. (Refused)

NA3. Are you aware of any programs besides Smart Energy Monitoring that [INSERT PA NAME, Cape Light Compact in this case] offers to help you save energy in your home?

1. (Yes)
2. (No)
98. (Don't Know)
99. (Refused)

[ASK IF NA3=1]

NA4. To the best of your knowledge, what energy efficiency programs does [INSERT PA NAME] offer? [OPEN END, 98="I don't remember any program names"] [MULTIPLE RESPONSE up to 3 programs]

Energy Efficient Equipment [ASK IF PART=1]

I am going to list equipment or appliances that might be in your home.

PE1. Does your home have a... [ROTATE; MULTIPLE RESPONSE; 1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)
a. Central air conditioning unit			
b. Room or window/wall air conditioning unit			
c. Clothes washing machine			
d. Clothes dryer			
e. Dishwasher			
f. Television			
g. Printer			
h. Computer			
i. Video game console			
j. Outdoor light fixtures			
k. Indoor light fixtures			
l. Boiler			
m. Furnace			
n. Refrigerator			
o. Pool			
p. Attic, ceiling or wall insulation			
q. Programmable thermostat			
r. On-demand or tankless water heater			
s. Energy efficient or double-paned windows			
t. Energy smart power strips (IF NEEDED: These are power strips or surge protectors that can automatically turn off peripherals for electronics when the main device - like a TV or computer - is not in use. For example, it could turn off the printer when your computer is asleep).			

[ASK IF PE1c=1]

PE2. Is your washing machine front-load or top-load?

1. Front load
2. Top load
98. (Don't Know)
99. (Refused)

[ASK IF PE1o=1]

PE3. Do you have a pool pump?

1. (Yes)
2. (No)

[ASK if any PE1a-t=1]

PE3a. Did you purchase or install any of the equipment or appliances we just discussed in the last year?

1. (Yes)
2. (No)
98. (Don't Know)
99. (Refused)

[ASK IF PE3a=1]

PE4. Did your household purchase or install [INSERT EACH PE1=1 and PE4=1; FOR PE1o=1, ASK ABOUT POOL PUMPS, NOT POOLS, IF PE3=1] in the past year? [MULTIPLE RESPONSE; 1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)
a. [INSERT EACH PE1a-t=1, FOR PE1o=1, ASK ABOUT POOL PUMPS, NOT POOLS, IF PE3=1]			
b.			

PE5a. Does your household currently have a second refrigerator?

1. (Yes)
2. (No)
98. (Don't Know)
99. (Refused)

[ASK IF PE5a<>1]

PE5b. Did your household have a second refrigerator at any point in the last year?

1. (Yes)
2. (No)
98. (Don't Know)
99. (Refused)

[ASK IF PE5b<>2]

PE5. Has your household recycled a second refrigerator within the last year?

1. (Yes)
2. (No)
98. (Don't Know)
99. (Refused)

[ASK IF PE1a=1]

PE6. How many years old is your central air conditioning unit?

1. [OPEN RESPONSE NUMERIC]
98. (Don't Know)

[ASK FOR ALL PE4a-h=1, PE4L-n=1, PE4q-r=1]

PE7. Was the [INSERT EACH PE4a-h=1, PE4L-n=1, PE4a-r=1] you installed in the last year an additional unit or replacement for an older model? [1=Additional, 2=Replacement, 98=(Don't Know), 99=(Refused)]

	Additional Unit or System (1)	Replaced an older model (2)	Don't Know (98)
a. [IF PE1a=1 & PE4a=1] Central air conditioning unit			
b. [IF PE1b=1 & PE4b=1] Room or wall air conditioning unit			
c. [IF PE1c=1 & PE4c=1] Clothes washing machine			
d. [IF PE1d=1 & PE4d=1] Clothes dryer			
e. [IF PE1e=1 & PE4e=1] Dishwasher			
f. [IF PE1f=1 & PE4f=1] Television			
g. [IF PE1g=1 & PE4g=1] Printer(s)			
h. [IF PE1h=1 & PE4h=1] Computer(s)			
i. [IF PE1i=1 & PE4i=1] Boiler			
m. [IF PE1m=1 & PE4m=1] Furnace			
n. [IF PE1n=1 & PE4n=1] Refrigerator			
q. [IF PE1q=1 & PE4q=1] Programmable thermostat			
r. [IF PE1r=1 & PE4r=1] On-demand or tankless hot water heater			

[ASK IF PE4a-n=1 except PE4d=1](Excludes items that are energy efficiency by definition)

PE8. To the best of your knowledge, is/are the [INSERT EACH PE4a-n=1, DO NOT INCLUDE PE4d] you purchased in the last year ENERGY STAR qualified? [MULTIPLE RESPONSE; 1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)
a. [INSERT EACH PE4a-n=1, except PE4d=1]			
b.			

Financial assistance for measures installed in past year[ASK IF PART=1]

[ASK IF PE3a=1]

[ASK FOR EACH PE4=1 EXCEPT where (PE1d=1 OR PE1i=1)] (REBATE-ELIGIBLE ITEMS)

PE9. Did you receive a rebate and/or tax incentive for the...? [INSERT EACH PE4=1 EXCEPT where (PE4d=1 OR PE4i=1)] [1=Rebate, 2=Tax Incentive, 3=(Other special pricing mentioned), 4=(None of these / no special pricing), 98=(Don't know), 99=(Refused)]

	Rebate (1)	Tax Incentive (2)	Other special pricing (3)	None of these (4)	Don't Know (98)
a. [INSERT EACH PE4=1 EXCEPT where (PE4d=1 OR PE4i=1)]					
b.					

Other energy saving measures[ASK IF PART=1]

PA1. Does your home have...? [Rotate; 1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)
a. Weather stripping or caulking around windows and/or doors			
b. Energy Star light bulbs or compact fluorescent lights, also known as CFLs*			
c. Low-flow shower heads			
d. Faucet aerators			
e. Water heater wrap			
f. Insulated outlets and/or light switches			
g. Fluorescent lights that are not compact (e.g. fluorescent bulbs that are longer and thinner than CFL)			
h. Motion sensors (e.g., for lighting)			
i. Lighting timer(s)			
j. Task lighting			
k. Storm windows			
l. Insulated window shades, window insulation or window quilts			

*These bulbs usually do not look like regular incandescent bulbs. The most common type of compact fluorescent bulb is made with a glass tube bent into a spiral, resembling a soft-serve ice cream, and fits in a regular light bulb socket.

PA2. Did you purchase or install any of the items we just discussed in the last year?

1. (Yes)
2. (No)
98. (Don't Know)
99. (Refused)

[ASK IF PA2=1]

PA2a-l. Did your household purchase or install [INSERT EACH PA1=1] in the past year? [1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)
a. [INSERT EACH PA1=1]			
b.			

PA3. Have you ever had a home energy assessment or audit, where someone from Mass Saves, Cape Light Compact or another organization came to your house and assessed your home's energy use?

1. (Yes)
3. (No)
98. (Don't Know)
99. (Refused)

[ASK IF PA3=1]

PA3a. Was this home energy assessment conducted within the past year, or more than 1 year ago?

1. Within the past year
2. More than 1 year ago
98. (Don't Know)

99. (Refused)

[ASK IF PA2a-l=1 AND PA3a=1]

PA4. Did your household receive the [INSERT EACH PA2a-l=1] within the past year as part of a home energy assessment? [MULTIPLE RESPONSE; 1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)
a. [INSERT EACH PA2a-l=1]			
b.			

[ASK IF PA2a-l=1]

PA5. Did you receive [INSERT EACH PA2a-l=1] for free?. [MULTIPLE RESPONSE; 1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)	INT PA6. If Yes: Specify source of free item
a. [INSERT EACH PA2a-l=1]				[OPEN END]
b.				

[ASK IF ANY PA5=1]

PA6. How or where did you receive the free [INSERT EACH PA5=1]? [OPEN RESPONSE]

Behavioral Actions Taken [ASK IF PART=1]

BA1. Do you regularly... [INSERT EACH BA1a-o] [MULTIPLE RESPONSE; 1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)
a. Hang laundry to dry			
b. Wash laundry in cold water			
c. [ASK IF PE1c=1] Fully load washing machine			
d. [ASK IF PE1e=1] Fully load dishwasher			
e. Turn off lights in unoccupied rooms			
f. [ASK IF PA1j=1] Use task lighting			
g. [ASK IF PA1i=1] Use lighting timer			
h. [ASK IF PE1j=1] Turn off outside lights by day			
i. [ASK IF PE1h=1] Turn off computers at night/when not in use			
j. [ASK IF PE1h=1] Put computer(s) to sleep			
k. [ASK IF PE1f=1] Turn off TV(s) when not in use			
l. [ASK IF PE1i=1] Turn off video game console(s) when not in use			
m. Switch off power strips or unplug devices when not in use (chargers, TVs, stereos, etc)			
n. [ASK IF PA1l=1] Lower window shades, insulation or quilts			
o. Take short showers			

[ASK IF ANY BA1=1]

BA2. Did you start taking any of the actions we just discussed in the past year?

1. (Yes)
2. (No)
98. (Don't Know)
99. (Refused)

[ASK IF BA2=1]

BA2a-o. INT: Did you start taking any of these actions within the past year? [CHECK BOXES; maintain sub-lettering of BA1]

PHN: Did you start [INSERT EACH BA1=1] within the past year? [MULTIPLE RESPONSE; 1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)
a. [INSERT EACH BA1=1, changing verb to "ing"]			
b.			

BA3. Do you regularly...[INSERT EACH BA3a-l] [ROTATE MULTIPLE RESPONSE; 1=Yes, 2=No, 96=(Not Applicable), 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Not Applicable (96)	Don't Know (98)
a. Use a portable window fan				
b. Maintain your heating and cooling system				
c. [ASK IF PE1m=1] Change the furnace filter				
d. [ASK IF PE1l=1] Clean the boiler water				
e. Reduce the water heater temperature				
f. Clean or replace air filters				
g. Clear the area around vents				
h. Make sure refrigerator seals are tight				
i. Clean refrigerator coils				
j. Check refrigerator temperature				
k. [ASK IF PE5a=1]Unplug a second refrigerator for weeks to months at a time				
l. [ASK IF PE1q=1] Set the thermostat to recommended set points (e.g. 78° F or higher for cooling/68° F or lower for heating)				

[ASK IF ANY BA3=1]

BA4. Did you start taking any of the actions we just discussed in the past year?

1. (Yes)
2. (No)
98. (Don't Know)
99. (Refused)

[ASK IF BA4=1]

BA4a-l. Did you start... [INSERT EACH BA3=1, adding -ing to action]...within the past year? [1=Yes, 2=No, 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Don't Know (98)
a. [INSERT EACH BA3=1, changing verb to "ing"]			
b.			

Additional Behavioral Actions [ASK IF PART= 1]

BA5. Are there any other actions you started taking in the past year to save energy in your home, besides the actions you've already mentioned? Please list up to three actions. [MULTIPLE RESPONSE]

- a. [OPEN RESPONSE]
- b. [OPEN RESPONSE]
- c. [OPEN RESPONSE]
- d. No actions

[ASK IF (BA1a-o=1 except IF BA2a-o=1) and BA2=2,98,99]

BA6. The next set of questions is about the actions you've been taking for more than a year. Did you [INSERT each BA1a-o=1 EXCEPT IF BA2a-o=1] more or less frequently in the past year compared with previous years? [1=Increased Frequency, 2=Decreased Frequency, 3=No change in frequency, 98=(Don't Know), 99=(Refused)]

	Increased Frequency (1)	Decreased Frequency (2)	No change in frequency (3)	Don't Know (98)
a. [INSERT EACH (BA1a-o=1 EXCEPT IF BA2a-o=1), using verb tense of BA1]				
b.				

[ASK IF (BA3a-l=1 except IF BA4a-l=1) and BA4=2,98,99]

BA7. Did you [INSERT each BA3a-l=1 EXCEPT if BA4a-l=1] more or less frequently in the past year compared with previous years? [1=Increased Frequency, 2=Decreased Frequency, 3=No change in frequency, 98=(Don't Know), 99=(Refused)]

	Increased Frequency (1)	Decreased Frequency (2)	No change in frequency (3)	Don't Know (98)
a. [INSERT EACH (BA3a-l=1 EXCEPT IF BA4a-l=1) using verb tense of BA3]				
b.				

Participant and Comparison Group Mills Ratio Questions [ASK ALL]

P1: I am going to read a list of statements. Please tell me if you strongly disagree, somewhat disagree, neutral, somewhat agree, or strongly agree. [ROTATE]

Question	1 Strongly Disagree	2 Somewhat disagree	3 Neutral	4 Somewhat agree	5 Strongly Agree
a. I am always looking for ways to improve my home.					
b. I/we always try new technologies before other people do.					
c. I/We trust my/our utility company					
d. We support investment in publicly funded projects that help other people reduce their cost of living.					
e. I do NOT feel responsible for conserving energy because my personal contribution is very small.					
f. My day-to-day life is so busy that I often forget to take actions that save energy.					
g. I regularly try to convince my friends and family to use less energy.					
h. I am more likely to change my actions if people I respect have already taken action.					
i. I am not willing to sacrifice my personal comfort in order to save energy.					

P2. Can you tell me how satisfied you are with Cape Light Compact? Would you say you are (READ CHOICES 1-5)?

1. Very Dissatisfied
2. Dissatisfied
3. Neither satisfied nor dissatisfied
4. Satisfied
5. Very Satisfied
8. (Don't know
9. (Refused)

P3. Have you visited the Cape Light Compact website in the past 12 months?

1. Yes
2. No
8. Don't know
9. Refused

[ASK if P3=1]

P4. How often do you visit the Cape Light Compact's general website?

1. At least every day
2. At least once a week
3. At least once a month
4. At least once every few months
5. At least once a year
6. Never
8. Don't know
9. Refused

Participant Questions for Customers [ASK IF PART=1]

Home Energy Email Report

[READ IF PROGRAM=ENERGIZE]

The next set of questions is about Cape Lights Compact (CLC) Smart Home Energy Monitoring Pilot (SHEMP) program, a program that provided you with online access to information about energy usage in your home, as well as on an in-home display.

First, I would like to confirm which features of the program you have used or accessed.

P1.		Yes (1)	No (2)	Don't know (98)	Refused (99)
[ASK IF PROGRAM=ENERGIZE]	a. Did you receive the Energize in-home display?				
[Ask All]	b. Have you ever accessed the SHEMP website to monitor your energy use?				

[ASK IF P1b = 1]

P2. How often to you log onto the program website?

1. At least every day
2. At least once a week
3. At least once a month
4. At least once every few months
5. At least once a year
6. Never
98. Don't know
99. Refused

[SKIP IF P2=6, 98, 99]

P3. What type of information do you seek out on the site? [OPEN END][Probe for if there is anything else? and accept after three]

[ASK IF P1a=1]

IHD1. Do you currently have the in-home display installed?

1. Yes
2. No

- 98. Don't know
- 99. Refused

[ASK IF IHD1 = 2]

IHD2. Why are you no longer using the in-home display?

- 1. [Open End]
- 2. (I never set up the device)
- 98 Don't know
- 99 Refused

[ASK IF IHD1 = 2 AND IHD2 = 1]

IHD3. Approximately when did you stop using the display?

- 1. About a week after it was installed.
- 2. About a month after it was installed.
- 3. About three months after it was installed.
- 4. About six months after it was installed.
- 5. About a year after it was installed.
- 98. Don't know
- 99. Refused

[ASK IF IHD1 =1]

P4. How often to you look at your in-home display?

- 1. At least every day
- 2. At least once a week
- 3. At least once a month
- 4. At least once every few months
- 5. At least once a year
- 6. Never
- 98 Don't know
- 99 Refused

[ASK IF P4 = 1,2,3,4, 5, or 6]

IH18. How does this frequency compare to when you first set-up the device? Would you say that you look at the device more frequently, less frequently or about the same frequency as when you first set-up the device?

- 1. More frequently
- 2. Less frequently
- 3. About the same frequency
- 98. Don't know
- 99. Refused

[SKIP IF P4=6, 98, 99]

P5. What information do you look for on the display? [OPEN END] [Probe for if there is anything else? and accept after three]

[ASK IF IHD1 = 1]

IH4. On a scale of 1 through 5, where 1 is "Not at all easy" and 5 is "extremely easy", how easy is it to understand the information on the in-home display? [1-5, 8=DK, 9=REF]

P6. On a scale of 1 to 5, where 1 is Not Useful at All and 5 is Extremely Useful, how useful would you say the following program offers are:

		Not at All Useful				Extremely Useful	Don't know	Refused
[Ask IF P1b=1]	1. The website	1	2	3	4	5	98	99
[Ask IF P1c=1]	2. The email reports	1	2	3	4	5	98	99
[Ask IF IHD=1]	3. The In-home display	1	2	3	4	5	98	99

P7. Now I would like to ask you about the information you received.

	Has the/have the . . .	Yes	No	Don't know	Refused
[Ask IF P1b=1]	1. website provided you with new ways to save energy in your home?	1	2	98	99
[Ask IF P1c=1]	2. email reports provided you with new ways to save energy in your home?	1	2	98	99
[Ask IF IHD=1]	3. in-home display provided you with new ways to save energy in your home?	1	2	98	99

P8.

	Has the/have the . . .	Yes	No	Don't know	Refused
[Ask IF P1b=1]	1. website provided you with enough information to take energy saving actions in your home?	1	2	8	9
[Ask IF P1c=1]	2. email reports provided you with enough information to take energy saving actions in your home?	1	2	8	9
[Ask IF IHD=1]	3. in-home display provided you with enough information to take energy saving actions in your home?	1	2	8	9

[ASK All]

P9. What, if anything, would make the program more useful to you? [OPEN END]

[ASK All]

P10. Since participating in the program, have you [1=Yes, 2=No, 96=(Not applicable), 98=(Don't Know), 99=(Refused)]

	Yes (1)	No (2)	Not Applicable (96)
a. Discussed or shared ideas on how to save energy with other people in your household?			
b. Discussed or shared ideas on how to save energy with your neighbors?			

P11. How much would you say your experience with the Smart Home Energy Monitoring program has affected your knowledge of ways to save energy in your home? Would you say it didn't change, increased a little, increased somewhat or increased a lot?

1. Didn't change
2. Increased a little
3. Increased somewhat
4. Increased a lot
- 98 Don't know
- 99 Refused

P12. Now, thinking about your overall experience with the program, has the program been useful in helping you to save money on your monthly energy bill?

1. Yes
2. No
98. Don't know
99. Refused

P13. This completes the survey. Is there anything else you would like to say about the program?

1. Yes [OPEN END] [Go to closing script]
2. No [Go to closing script]

Extended Demographic Battery [ASK IF PART=0]

Preferred Channels for Energy Usage Information

P7b. We'd like to know how you might like to receive information about your household energy usage. For example, how much energy your home uses, how your energy usage compares to similar homes, or tips for saving energy in your home. Would you like receiving information about your home energy usage...? [ROTATE; MULTIPLE RESPONSE, 1=yes, 2=no, 98=DK, 99=REF]

1. By Paper report
2. By Utility bill
3. By Online website or portal
4. By Email
5. By Text message
6. By Voicemail
7. In another way [SPECIFY]

Utility and Water Heating

S5. Are you responsible for paying any of the following bills? [MULTIPLE RESPONSE]

- a. Electric
- b. Gas

- c. Water
- d. Waste & Trash
- e. Propane
- f. Heating fuel oil
- g. Cable Television
- h. None

98=(Don't Know)

99=(Refused)

DE1. Do you rent or own your home or apartment?

- 1.(Own)
- 2. (Rent)
- 3. (Other: Specify_____)
- 98. (Don't know)
- 99. (Refuse)

DE2. What is your age?

- 1. (24 yrs or younger)
- 2. (25 to 34 yrs)
- 3. (35 to 44 yrs)
- 4. (45 to 54 yrs)
- 5. (55 to 64 yrs)
- 6. (65 years and over)
- 98. (Don't Know)
- 99. (Refused)

DE3. Including yourself, how many people live in your household on a full time year-round basis?

- 1. [NUMERIC OPEN END]

DE4. How many children 18 years or younger live in your household (full time year-round)?

- 0. (None)
- 1. (1)
- 2. (2)
- 3. (3)
- 4. (4)
- 5. (5)
- 6. (6)
- 7. (7)
- 8. (8)
- 9. (9 or more)
- 98. (Don't know)
- 99. (Refuse)

DE5. What is the highest level of education you have completed?

- 1. (Less than high school)
- 2. (High school graduate or equivalent)
- 3. (Some college, no degree)
- 4. (Associate's degree)

- 5. (Bachelor's degree)
- 6. (Graduate or professional degree)
- 98. (Don't know)
- 99. (Refused)

DE6. Please stop me when I get to the range of your household's total annual income before taxes:

- 1. Less than \$25,000
- 2. \$25,000 - \$34,999
- 3. \$35,000 - \$49,999
- 4. \$50,000 - \$74,999
- 5. \$75,000 - \$99,999
- 6. \$100,000 - \$149,000
- 7. \$150,000 - \$199,999
- 8. \$200,000 or more
- 98. (Don't know)
- 99. (Prefer not to respond)

DE7. Respondent Gender? (Observation – Do not ask)

- 1. Male
- 2. Female

U2. How is your hot water heated? [OPEN END]

- 1. Electricity
- 2. Natural gas
- 3. Propane
- 4. Other [SPECIFY]
- 8. (Don't Know)
- 9. (Refused)

Demographics

D1. What kind of home do you live in? [TRACK IN DAILY DISPO REPORT]

- 1. A mobile home
- 2. A single-family detached residence
- 3. A single-family attached residence (for example, a townhouse)
- 4. An apartment or condominium in a building with 2-4 units
- 5. An apartment or condominium in a building with 5 or more units
- 6. Other [SPECIFY]

D2. What is the approximate square footage of your home?

- 1. [NUMERIC OPEN END]
- 98. (Don't Know)
- 99. (Refused)

[ASK IF D2=98]

D3a. How many rooms, excluding bathrooms are in your house?

- 1. [NUMERIC OPEN END]
- 98. (Don't Know)
- 99. (Refused)

[ASK IF D2=98]

D3b. How many bedrooms are in your house?

- 1. [NUMERIC OPEN END]
- 98. (Don't Know)
- 99. (Refused)

[ASK IF D2=98]

D3c. How many bathrooms are in your house?

- 1. [NUMERIC OPEN END]
- 98. (Don't Know)
- 99. (Refused)

D4. When was your house built, approximately?

- 1. Before 1900
- 2. 1900 - 1939
- 3. 1940 - 1959
- 4. 1960 - 1979
- 5. 1980 - 1989
- 6. 1990 - 1999
- 7. 2000 - 2004
- 8. 2005 or later
- 98. (Don't Know)
- 99. (Refuse)

D5. Over the past year, has there been a change in the number of people who live in your household on a full time year-round basis?

- 1. Yes, an increase in occupancy
- 2. Yes, a decrease in occupancy
- 3. No change
- 98. (Don't Know)
- 99. (Refuse)

D6. Over the past year, has there been a change in the employment status of people living in your home? (A change in employment status could be a change in the number of people working, or the number of hours worked by people in your home.)

- 1. Yes, an increase in employment status
- 2. Yes, a decrease in employment status
- 3. No change
- 98. (Don't Know)
- 99. (Prefer not to answer)

D7. Are you of Hispanic, Latino, or Spanish origin?

- 1. Yes
- 2. No
- 98. (Don't Know)
- 99. (Prefer not to answer)

D8. Which of the following best describes your race? [MULTIPLE RESPONSE]

- 1. White
- 2. Black or African American
- 3. American Indian or Alaska Native
- 4. Asian Indian
- 5. Chinese
- 6. Filipino
- 7. Japanese
- 8. Korean
- 9. Vietnamese
- 10. Other Asian
- 11. Native Hawaiian or Other Pacific Islander
- 00. Other [SPECIFY]
- 98. (Don't Know)
- 99. (Prefer not to answer)

D9. How would you characterize yourself in terms of politics? Would you say you are:

- 1. Very liberal
- 2. Somewhat liberal
- 3. Moderate
- 4. Somewhat conservative
- 5. Very conservative
- 98. (Don't Know)
- 99. (Prefer not to answer)

Thank you for your participation. The Cape Light Compact value your opinion. Your responses have been recorded and all of your responses will be kept confidential.

Those are all the questions I have. Thank you for taking this survey.

L. CLC SHEMP REGRESSION COEFFICIENTS

Regression Results

Table 86. Model 1 Energize 24-Month Matches

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
pre_avgdailykwh	1	0.88936	0.00353	251.89	<.0001
LISF_post	1	2.49796	0.54164	4.61	<.0001
MFR_post	1	-3.36088	1.34238	-2.5	0.0123
RHE_post	1	-0.34529	0.16339	-2.11	0.0346
RP_post	1	-0.67095	0.17885	-3.75	0.0002

Table 87. Model 2 Energize 24-Month Matches

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
pre_avgdailykwh	1	0.90133	0.00395	228.27	<.0001
LISF_post	1	2.19904	0.68252	3.22	0.0013
MFR_post	1	-4.59681	1.69234	-2.72	0.0066
RHE_post	1	-0.19865	0.23653	-0.84	0.401
RP_post	1	-1.42533	0.26198	-5.44	<.0001

Table 88. Model 1 Energize 12-Month Matches

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
pre_avgdailykwh	1	0.87928	0.00369	238.58	<.0001
LISF_post	1	-1.12553	0.42065	-2.68	0.0075
MFR_post	1	-4.91961	0.98589	-4.99	<.0001
RHE_post	1	-0.60758	0.16502	-3.68	0.0002
RP_post	1	-0.20891	0.18027	-1.16	0.2465

Table 89. Model 2 Energize 12-Month Matches

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
pre_avgdailykwh	1	0.88629	0.0042	211.27	<.0001
LISF_post	1	-2.35481	0.4699	-5.01	<.0001
MFR_post	1	-6.11385	1.0833	-5.64	<.0001
RHE_post	1	-0.64789	0.2304	-2.81	0.0049
RP_post	1	-0.22649	0.25317	-0.89	0.371

Table 90. Model 1 Legacy Standard Matches

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
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pre_avgdailykwh	1	0.85176	0.00608	140.2	<.0001
LISF_post	1	-0.72029	0.76497	-0.94	0.3464
RHE_post	1	-1.21223	0.25276	-4.8	<.0001
RP_post	1	-1.27776	0.24021	-5.32	<.0001

Table 91. Model 2 Legacy Standard Matches

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
pre_avgdailykwh	1	0.87968	0.00687	127.99	<.0001
LISF_post	1	-0.9496	0.93353	-1.02	0.3091
RHE_post	1	0.14422	0.40389	0.36	0.721
RP_post	1	-1.50342	0.35116	-4.28	<.0001

Table 92. Model 1 Legacy Low-Trend Matches

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
pre_avgdailykwh	1	0.85261	0.00607	140.5	<.0001
LISF_post	1	-0.63189	0.69888	-0.9	0.3659
RHE_post	1	-0.71546	0.24862	-2.88	0.004
RP_post	1	-1.51638	0.21947	-6.91	<.0001

Table 93. Model 2 Legacy Low-Trend Matches

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
pre_avgdailykwh	1	0.88448	0.00684	129.39	<.0001
LISF_post	1	-1.08412	0.81371	-1.33	0.1828
RHE_post	1	1.55973	0.39502	3.95	<.0001
RP_post	1	-2.02836	0.29419	-6.89	<.0001